SKYLAB

THE FORGOTTEN MISSIONS

A Senior Honors Thesis

by

MICHAEL P. JOHNSON

Submitted to the Office of Honors Programs
& Academic Scholarships
Texas A&M University
In partial fulfillment of the requirements of the

UNIVERSITY UNDERGRADUATE
RESEARCH FELLOWS

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ABSTRACT

Skylab

The Forgotten Missions. (April 2004)

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The Skylab program featured three manned missions to America's first and only space station from May 1973 to February 1974. A total of nine astronauts, including one scientist each mission, flew aboard the orbital workshop. Since the Skylab missions contained major goals including science and research in the space environment, the majority of publications dealing with the subject focus on those aspects. This thesis intends to focus, rather, on the human elements of the three manned missions. By incorporating not only books, but also oral histories and interviews with the actual participants, this work contains a more holistic approach and viewpoint. Beginning with a brief history of the development of a space station, this document also follows the path of the nine astronauts to their acceptance into the program. Descriptions of the transition period for NASA from the Moon to a space station, a discussion on the main events of all the missions, and finally a look at the transition to the new space shuttle comprise a major part of the body. This document also analyzes the place of Skylab in the history of NASA.

ACKNOWLEDGMENTS

When coming up with a topic for my Fellowship, I knew that I wanted to write a thesis, but the topic became a difficult choice. After circumstances that I do not now recall, I came to realize that my parents had met Dr. Joseph Kerwin, and thus I came to Skylab. So, my inspiration comes directly from him.

I have to begin by thanking my Faculty Advisor, Dr. Jonathan Coopersmith. I basically came to him out of necessity, after a recommendation from Mrs. Robyn Konrad, and I must have sounded like a lost History student. I had not met him before, but he was kind enough to take on this responsibility and help guide my work. Certainly, I should have used his expertise more, and I am still sorry I did not seek his help earlier for editing. Only after meeting with him did I truly realize that I could have done so much more. Nonetheless, I am happy with this product.

A very special thanks goes to my parents, especially my mom, who has been my personal editor for as long as I have been writing for school. My fondest memories are of sitting on the couch or their bed going over a paper I could care less about but her helping me along. She has always been my great inspiration. I cannot leave out my dad, who inspires me in so many other ways. I can never say enough thanks to both of you.

Thanks also to my lovely Lauren. Though you may not know it, you have helped me survive this trial. Never change who you are and how you affect me.

Also, to my brothers and sisters, who have always given me great advice and examples of how to live my life. Especially to Rob, who has been a great roommate and lived through my times being shut up in my room and no fun.

I owe a lot to Dr. Kerwin. Not only was he an inspiration to choose this as my topic, he was kind enough to sit down with me for an hour and share a part of his life. That event I will never forget. He put up with my nervousness and helped make my first interview a successful one.

I would also like to thank Mrs. Shelly H. Kelly of the University of Houston-Clear Lake archives. I went into her office one day on Winter Break with one source, and came out with so much information I could never use it all. Also a thank you to the countless individuals who worked on the sources I used. Without those, they paper would, obviously, never have been written.

Finally, a thank you to all those who helped in this mission. Though you deserve so much more for committing your lives to helping others, it is the best I can do at this point. Your accomplishments and work will never be forgotten.

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INTRODUCTION

Why did America's National Aeronautics and Space Administration [NASA] embark on the Skylab mission? Skylab was America's first and, so far, only space station. One can say this with conviction since the International Space Station is, in fact, an international cooperation, although run mostly by the United States. Skylab was also NASA's first endeavor dedicated primarily as a science and research mission in space. Certainly some of the goals in the Mercury and Gemini missions pertained to science, but for the most part NASA used them only as a precursor to Apollo. In fact, the space agency specifically aimed most of the goals in those missions at making sure that everything could be accomplished successfully to reach the Moon.

On May 25, 1961, President John F. Kennedy gave what would become the most important speech in NASA's brief history. Given at Rice University in Houston, Texas, a city which soon would be home of the Manned Spacecraft Center, Kennedy outlined the immediate future of the space program.

> We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we will accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.[1]

Later in the speech, he reiterated that "this will be done in the decade of the Sixties."

Journal Format is: *The Chicago Manuel of Style*

Of course, his prophetic words ultimately came true, when Neil Armstrong set foot on the moon July 20, 1969 as part of Apollo 11.

Even before this, and certainly during the Apollo program, another concern loomed in the back of many NASA officials' minds: what follows Apollo? What could possibly live up to the awe and grandeur of reaching another celestial body? From early on, the answer to this question was a space station. In fact, one can trace the idea of a space station back to a story by Edward E. Hale published 1869-1870.[2] Since then, many incarnations took hold. Interestingly, the most outspoken proponent for an American Space Station was Wernher von Braun, the premier rocket scientist of his day.

Despite the fact that scientists had contemplated the possibility of a space station for decades, one would hardly think that the program that would become Skylab could live up to the notoriety and prestige of missions to the moon. In fact, history suggests that only missions to another body, such as Mars, could gain as much attention and praise, as well as monetary support. Numerous members of NASA even looked down on Skylab as a waste of time and energy. Some, such as John G. DeFife, an engineer in the Flight Technology office, felt "left behind" when he had to work on Skylab, while others moved on to the seemingly more exciting new Space Shuttle. In fact, he felt as though "Skylab was sort of a bitter time in my NASA career."[3] While certainly not all of NASA felt this way, the fact that this was present, along with other evidence, leads to the conclusion that Skylab seems to be the most forgotten missions.

Historians and authors have devoted a considerable amount of research to the Mercury missions. The public's love affair with NASA's first space program continued especially with *The Right Stuff* written by Tom Wolfe in 1979 and the movie of the same name directed by Philip Kaufman in 1983. The Apollo program is arguably the most popular space program, as evidenced by the myriad of publications on the missions and the 1995 box-office hit *Apollo 13* directed by Ron Howard. Even a 1998 HBO miniseries *From the Earth to the Moon* dealt extensively with the Apollo program. Certainly the more recent Space Shuttle and International Space Station receive their share of public and media awareness. Even the Gemini program received more scholarly research than Skylab. Overall, perhaps only the Apollo-Soyuz program has received as little notice as the Skylab program.

Even so, a fair amount of information is available on Skylab, if one searches in the correct places. By combining the resources of the handful of books and oral histories, one notices a predominance of scientific and research information. But what of the men who made these missions possible? While the science and space research is clearly important and the main goal of the missions, these would not be possible without the men who worked in the Skylab program. Therefore, one can take a more comprehensive look at the human elements of Skylab only after combining the resources and sifting out the immense amount of technical data. The goal of this paper is to make that human side of the mission more public and easier to understand.

DEVELOPMENT

While the idea for space travel and a space station had surfaced in writings for decades, one can trace the reality of this technology back only to post-World War II. Germany used many of the most brilliant minds of the time to create the first rockets used during the Second World War. Many of these same men later moved to the United States and some formed the basis of the early space agency, the National Advisory Committee for Aeronautics [NACA].

In 1958, NASA was born, as the nation's interest in space travel was forming. In June 1959, Wernher von Braun of the Army Ballistic Missile Agency unveiled his Project Horizon to use a spent booster stage as the base for a station, an idea later referred to as the "wet-stage" concept.[1] Over the years von Braun would continually fight for his space station idea, and would eventually see it come to fruition.

The next major step in the formation of a space station came the following year in 1960. Douglas Aircraft Company built a full-size model of a proposed four-man, wet-stage station. Housed in Empire Hall in London, it was sixty-two feet high and seventeen feet across.[2] Not only was this a chance for developers to see their ideas in three dimensions, it also was a great publicity tactic to interest the public in such a concept. By building this model, engineers and lay people alike could more easily visualize what previously many suggested only as a completely imaginary and inconceivable idea, but instead now made it much more realistic and possible.

The idea of an American Space Station was stalled, however, on July 5, 1960 when the House Committee on Science and Applications stated that the goal of putting a man on the Moon in the 1960's was a high-priority for the nation.[2] This was later compounded by the more public and more influential speech to the same effect by President John F. Kennedy on May 25,1961 at Rice University, as cited above. Both of these, while committing a large sum of money and national prestige behind the space program and in particular the missions to the moon, destined the space station to a less prominent role. While NASA still allocated some resources to researching possibilities for long-duration missions, the vast majority of time, talent, and funding went solely to the space race to the moon. Therefore, few developments in this area would come about until more attention was given elsewhere than the Apollo program.

While in NASA some developments were surfacing on the idea of a space station, the United States Air Force [USAF] announced on December 10, 1963 its plans for a Manned Orbiting Laboratory [MOL] in conjunction with NASA. This plan would use modified Gemini capsules in a combined fifty-four foot long research laboratory. The missions could last up to thirty days but not be resupplied or reused. Also, while they would not use any NASA civilian astronauts, the selection process and qualifications would be similar to NASA's astronaut corps.[4] Certainly, these people outside of NASA noticed the military potential of near-Earth orbit stations. While this particular plan did not ultimately come to realization, one can attribute some important advancements to the Skylab program to the USAF MOL.

A group of twenty individuals, named the Space Medicine Advisory Group [SMAG] met eight times between January and August 1964 to discuss such elements as life-support, experiments, and design requirements for the proposed NASA station. SMAG proposed that 30- and 90-day missions were too short to study and examine adequately the long-term effects of microgravity and space in general on the human body. It, in fact, stated that the mission should last at least one year of continuous orbit, rather than the series of shorter missions proposed in the MOL program.[5] Two specific findings from this study would later directly affect the Skylab program. First, the SMAG group argued for the necessity of an emergency contingency that could rescue the crew in the case of a crisis. They also suggested a simulation on the ground before the actual missions in space to understand better the needs of a crew isolated for so long and to test the equipment.[6] Similar other groups would, over time, present ideas to aid the formation of a space station. While some were more influential than others, the very existence of such organizations substantiate that this idea was always important, even if not in the national spotlight.

Around this time, the Marshall Space Flight Center in Huntsville, Alabama began to incorporate von Braun's old idea of a wet-stage space station in the Apollo program by testing the feasibility of using Apollo systems to build a space station. This fact greatly irked many of the officials at the Manned Spaceflight Center in Houston,[7] because they did not like the idea of the Marshall Center gaining a more prominent role in what they saw as their niche in NASA, and some of these animosities would propagate later in the Skylab program. On July 30, 1965, the Apollo Extension System [AES] began researching the idea of using many smaller pieces to build a bigger station than NASA could make with just one piece, a concept that would later be adopted by Russia's MIR station and the International Space Station.[8] This again illustrates the fact that NASA may not immediately use many of the ideas originating at this time and earlier, but they may revisit them in later programs.

The year 1965 also witnessed the formation of the Apollo Applications Program [AAP], an American space station. The following year saw the first mention of the Apollo Telescope Mount [ATM],[9] which, as a major solar observatory, would eventually play such a vital role in the Skylab program. On March 23, 1966, NASA announced the first, rather ambitious, AAP schedule, with a total of forty-five launches including nineteen Saturn V rockets and twenty-six Saturn 1B rockets. While the ultimate schedule would absolutely depend on the completion of the Apollo program, the Administration originally planned the first launch for April of 1968.[10] They eventually greatly reduced and continuously pushed back the final schedule. One can, however, easily see and admire NASA's ambition for a challenging schedule for the space station in these early planning days.

August 13-15, 1966 saw the roles of the centers in the proposed station set. Marshall, in Huntsville, was in charge of the living quarters and lab components, while the center in Houston would handle mission operations, as usual. Both, however, would also concern themselves with the experiments, depending on the make-up of each experiment. Meanwhile, the center at Cape Canaveral in Florida would handle the payload integration and launch facilities again.[11] All would have to deal with a continuously shrinking budget. The roles of each center would remain relatively the same throughout the program, and each learned to work cooperatively in order to complete the mission successfully.

In the next few years, NASA integrated some new concepts into the program. To begin with, on June 1, 1967, Deke Slayton and Chris Kraft together announced the plan to first launch the unmanned portion of the station and then later, if the station functioned, launch the manned missions to the already orbiting station.[12] This, of course, would eventually happen. Perhaps this saved the program, as evidenced later by the almost catastrophic events shortly after launch of the unmanned station. Also, in mid-November, NASA first introduced the originally not used dry workshop concept. This idea was to launch an unfuelled and pre-manufactured station, instead of using an already used Saturn V section that the astronauts would have to build on-orbit.[13] Eventually, this dry workshop would clearly become more feasible and much easier and less expensive. Almost two years later, in May of 1969, both Wernher von Braun and Robert Gilruth, then Director of the Manned Spacecraft Center in Houston, recommended the dry workshop over the wet workshop.[14] Finally, on July 18, the new NASA administrator, Tom Paine, officially approved the dry workshop space station.[15] In a relatively short period of time, the basis of the station completely changed. Certainly, this was due to the overwhelming amount of advantages of the dry workshop as well as the influential members backing the idea. This significantly changed the mission, for the better, and helped the mission work within the ever-shrinking budget.

Over this period of time, NASA continuously updated the amount of launches, as well as the schedule for them. In December 1966, the first launch was scheduled for June 1968 with a total of fifteen Saturn V and twenty-two Saturn 1B launches.[16] The tragic accident of Apollo 1 would greatly change the future missions. In May 1967, the initial launch was pushed back to at least "early 1969."[17] Two months later, the AAP was down to seven Saturn V and seventeen Saturn 1B rockets, with the first launch no earlier than March 1970.[18] In December, NASA again delayed the launch to April 1970 with three of each Saturn rockets used.[19] June 4th of the next year, the revised schedule saw the first launch in November 1970 with a new lineup of only one Saturn V but with eleven Saturn 1B rockets.[20] On July 22, 1969, NASA moved the launch date to July 1972, and the total number of launches reduced to only four.[21] Perhaps these many changes stemmed from the fact that the budget for this project continually decreased, and the schedules and guidelines had to reflect those decreases.

On February 17, 1970, NASA officially renamed the Apollo Applications Project as Skylab.[22] The new name, presumably, was supposed to give the program more credibility and give those involved a better sense of their mission. Also that year, the Administration announced the first full schedule. The unmanned workshop would launch November 9, 1972, followed by the first crew the next day for a 28-day mission. The second crew would launch January 19, 1973 for a 56-day mission, and the final crew was scheduled for departure on May 1, 1973 for another 56-day mission.[23] In April 1971, the launches were rescheduled for April 30, 1973, followed by the first crew May 1, the second crew July 30, and the final crew October 28, 1973.[24] Yet again, NASA announced on April 5, 1973 the, seemingly, final change. The unmanned mission, named SL-1, would launch May 14, 1973. The next day, the first crew, SL-2, would follow and would return on June 12th. The second crew, SL-3, would launch August 8th and return October 3rd. The third and final crew, SL-4, was scheduled for launch November 9th with reentry expected on January 4, 1974.[25] While the launch schedule would again change due to unforeseen events, this would finally mark the actual date for the initial launch of the unmanned Skylab space station. These many changes highlight the very flexible nature of NASA. Numerous events led to each delay, some more critical than others. All the while, one can see that NASA was striving to find the best, most efficient time to initiate these missions. These many changes also show a project struggling to survive under the numerous decreases in budget and lack of support.

ASTRONAUT SELECTION

In the early years of NASA, astronaut selection came down to what they needed in the immediate future. Each group filled a certain need. For instance, the very first group, the Original Seven, consisted completely of test pilots to fly the Mercury capsules. Not one of these Original Seven, however, flew on Skylab.

Pete Conrad had the longest tenure of any Skylab astronaut (Table 1 lists the Skylab astronauts). From the "Next Nine", the second group of astronauts selected September 17, 1962, came Lieutenant Charles "Pete" Conrad, Jr.[1] On October 17, 1963, NASA selected "The Fourteen", the third group of astronauts. This saw the inclusion of future Skylab astronaut Lieutenant Alan L. Bean.[2] After these selections, there was a hiatus in the selection of new astronauts. Those already in the corps would easily fill all slots, for the foreseeable future. Conrad would fly on two Gemini missions, as well as command Apollo 12, whose crew also included Alan Bean.[3] Both astronauts were, therefore, the only two experienced astronauts who flew on Skylab. They each had important knowledge for these missions, for even just being in space was more experience than the others, which enabled them to successfully command their Skylab crews.

NASA decided that they needed to include more candidates into astronaut selection. The idea was to include scientists, instead of just pilots, so that more useful scientific contributions could result from both missions to the moon and any future missions. On October 19, 1964, NASA officially announced its search for those scientist-astronauts. The criteria included that the applicant must have been born after August 1, 1930, a citizen, no taller than 6 feet, and hold a Ph.D. in natural sciences, medicine, or engineering. NASA also expressed a preference for previous flight experience, although that was, by no means, necessary.[4] Following a long selection process, the names an announcement came June 28, 1965. Included in this group of scientist-astronauts were Dr. Owen K. Garriott, Dr. Edward G. Gibson, and Lieutenant Commander Joseph P. Kerwin, MD.[5] These three scientists would form the core of the Skylab astronauts and, indeed, would set these missions apart from previous missions with their scientific input.

The planned USAF MOL station had its own selection of military officers. Apart from that, MOL astronauts had to have a BS degree and have graduated from the Aerospace Research Pilot School, at Edwards Air Force Base, California.[6] When they cut their program, the USAF asked NASA if they could take any of the astronauts. On April 4, 1966, the "Original Nineteen" came aboard NASA, including future Skylab astronauts Major Gerald P. Carr, Captain Jack R. Lousma, Major William R. Pogue, and Lieutenant Commander Paul J. Weitz.[7] Obviously, the largest number of participating astronauts came from this group. This probably stems from their time of selection, for astronauts from earlier classes had already filled almost all the Apollo program slots. When it came time to find jobs for these men, the office working on the space station became the easiest target for most of these men. This time in the office and their lack of earlier flights made them the most likely candidates for filling spots to fly on Skylab missions.

Interestingly, all but two of the Skylab astronauts were military personnel. Of course, the majority of civilian astronauts did not fly until the Space Shuttle, which allowed more astronauts to fly. Each group filled a certain need, but the qualifications stayed relatively the same throughout. That is, at least, until NASA opened the astronaut ranks for the scientist-astronaut group.

TABLE 1: Skylab Astronauts

Name	Qualification	Group
Lt. Charles Conrad Jr.	USN	Next Nine
Lt. Alan L. Bean	USN	The Fourteen
Dr. Owen K. Garriott	Ph.D., electrical engineering	Scientist
Dr. Edward G. Gibson	Ph.D., physics	Scientist
Lt. Cmdr. Joseph P. Kerwin, MD	USN	Scientist
Maj. Gerald P. Carr	USMC	Original Nineteen
Capt. Jack R. Lousma	USMC	Original Nineteen
Maj. William R. Pogue	USAF	Original Nineteen
Lt. Cmdr. Paul J. Weitz	USN	Original Nineteen

ASTRONAUT BACKGROUNDS

The nine astronauts who lived on Skylab each have their own history. Seven of the nine spent part of their life in the military before joining NASA, four of which joined the Navy. The other two astronauts held Ph.D.'s.

Looking into their early lives, they posted very diverse backgrounds. The majority asserted that they were always interested in flying. Some were strictly technical. Despite these differences, their lives coalesced while working at the same place trying to accomplish the same goal.

Captain Charles "Pete" Conrad was born in Philadelphia, Pennsylvania on June 2, 1930. After college, he became a test pilot in the United States Navy. Conrad actually applied and went relatively far in the selection process for the Original Seven Mercury astronauts. NASA finally accepted him in September of 1962 as part of the "Next Nine". He flew on two Gemini missions (V and XI) and commanded Apollo XII before joining the SL-2 crew as their commander.[1]

From an early age, while living in Oak Park, Illinois, Lieutenant Commander Joseph P. Kerwin, MD, born February 19, 1932, professed an interest in space exploration. When he was older, however, he went to medical school, and was selected by a special draft just for doctors when he graduated. Once in the Navy, he became one of the few Flight Surgeons who also gained his wings. While in the Navy, he met Jim Lovell and Alan Bean, fellow future astronauts, and actually helped them fill out their forms to become an astronaut. When NASA announced in 1962 that they would be accepting scientist-astronauts, Kerwin applied and was accepted as one of two with both a medical degree and his wings.[2] For Kerwin, the opportunity fulfilled a life-long dream and allowed him to become the first American medical doctor in space.

Lieutenant Commander Paul J. Weitz, born July 25, 1932 and from Erie, Pennsylvania, wanted to be a Naval aviator from an early age, following in the footsteps of his dad, a World War II veteran. Before joining NASA, he met fellow future NASA employees Alan Bean, Jack Lousma, Eugene Cernan, and Ron Evans, inside connections who may have helped him gain acceptance into the astronaut corps. While becoming an astronaut was not one of his main goals, he confessed that he applied since it had the potential to be better than his current job in the Navy.[3] Weitz joined NASA as part of the Original Nineteen as one formerly in the MOL group. He served as the pilot of SL-2, completing the group with Conrad and Kerwin. Thus, SL-2 consisted of an all Navy pilot crew.

Growing up in Wheeler, Texas, Lieutenant Alan L. Bean, born March 15, 1932, said that he always wanted to be a pilot because he strove to be brave.[4] Once in the Navy, he became a test pilot partially because it was the most daring, but also because it offered him greater variety in experiences and challenges. Similarly, he applied to NASA because he felt the astronaut program would provide the next step in a logical career progression.[5] Bean was selected in "The Fourteen" group in October 1963. Bean flew on Apollo XII as the lunar module pilot, and walked on the moon with Pete Conrad, the third and fourth men to do so. This unique experience certainly helped him gain the renown needed to become the commander of SL-3.

Dr. Owen K. Garriott, born in Enid, Oklahoma on November 22, 1930, was also interested in space from an early age. While he did join the NROTC,[6] he stayed in school to attain his Ph.D. in electrical engineering rather then join the service. His love for space never died, however, and he trained to secure his pilot license in an attempt to try to help his chances of acceptance by NASA.[7] Garriott was accepted in the scientist-astronaut group. Even though he did have his pilot license, he still had to go directly to flight school with the military in order to get his wings to become a true astronaut.[8] After this flight training, he, like many others, worked in different offices within NASA before learning that he was selected to fly as the scientist in the second Skylab manned mission.

Captain Jack R. Lousma, like many other astronauts, envisioned himself flying from an early age.[9] Lousma was born in Grand Rapids, Michigan on February 29, 1936. After college, he joined the Marines only because both the Air Force and the Navy did not accept married pilots. As a unique episode of applying to NASA, Lousma actually responded to a newspaper advertisement by NASA saying they were looking for new pilots.[10] Lousma joined the team as part of the Original Nineteen MOL astronauts. SL-3 was his first time in space. He acted as pilot, joining Bean, the commander, and Garriott, the scientist.

Major Gerald P. Carr, born August 22, 1932, had interests in technology and aviation since he was a young boy growing up in Santa Ana, California.[11] As a result, he joined the Marines with the ambition of becoming an aviator in the mid-1960's.[12] In 1965, he applied to NASA simply to see how far he could get in the process.[13] To his surprise, he was selected as another member of the Original Nineteen. Interestingly, Carr's goal was not to become an astronaut, unlike many of the others.[14] He simply applied because the opportunity arose to him; surprisingly he was accepted. As another surprise to many in the NASA community, the Administration chose Carr as the rookie commander of SL-4, leading an all-rookie crew, the first since Gemini. This announcement of Carr leading an all-rookie crew upset at least one astronaut. Walter Cunningham, who had worked in the AAP office since 1968 and had flown on Apollo VII, left NASA after he learned that he would not fly on any of the missions and had not received the third commander position.[15] Those in charge of the selection, especially Deke Slayton, must have found something that they liked about Carr and the others.

Born on November 8, 1936, Dr. Edward G. Gibson was extremely interested in science, especially astronomy, from his elementary school days in Buffalo, New York.[16] While he was a graduate student at Cal Tech, on his way to a Ph.D. in physics, Gibson closely followed the first NASA programs of Mercury and Gemini.[17] When the scientist-astronaut application time arrived, it seemed a perfect fit for the astronomy enthusiast. Gibson joined NASA only after accomplishing flight training with some of the other scientist-astronauts, a time he said was very difficult with "a steep learning curve."[18] Gibson became the third scientist to fly on Skylab. His physics and astronomy background proved invaluable to the solar observations of the mission.

Major William R. Pogue, born January 23, 1930 in Okeman, Oklahoma, was another young boy "fascinated by aircraft." Pogue, one of the older men in the group, actually started flying during the Korean War with the intention of becoming a teacher.[19] Then, in the mid-1950's, a new group of high-performance flyers called the Thunderbirds began touring the nation. Fascinated, Pogue became one of the lucky few who took part as one of these most skilled pilots.[20] He also followed the space race very closely.[21] When an opportunity became apparent, he applied and was accepted into NASA. Pogue entered with the Original Nineteen, and worked in the NASA offices until selected as the pilot of SL-4, joining the all-rookie crew of Carr, Gibson, and Pogue. The all-rookie status of this crew received greater critical scrutiny than the others, since bad and unseasoned judgement calls reflected in their mission.

The astronauts of Skylab hailed from a wide variety of backgrounds, from different areas of the county. Most expressed an early interest in either space or flight, and they pursued this interest in their careers. Some, like Kerwin and Weitz, actually knew some NASA astronauts before their selection; which may have helped their application process. One thing is certain, despite their various histories; they all believed in their mission and worked together as a team, both within, and between, their crews.

FROM APOLLO TO SKYLAB

As a mission, Skylab naturally held many firsts. It was the first, long-duration flight in NASA history. The previous duration record had been fourteen days, set by Gemini VII.[1] Not only would the first crew double that to twenty-eight days, but the second crew would more than double that again to fifty-nine days, and the third would stay up an astonishing eighty-four days. This distinction offered a major challenge for the controllers in Houston, for they would have to maintain complete vigilance for that period of time rather then the week or so they had experienced with Apollo.

Likewise, since Skylab was orbiting the Earth, tracking would pose another difficulty. While Goddard Space Flight Center in Maryland managed the tracking,[2] various site locations ranged from Fairbanks, Alaska to Orroral Valley, Australia to Corpus Christi, Texas and many places in between.[3] Despite this extensive coverage, NASA could not track Skylab for a significant amount of the time. As a result, a recorder saved, on a second loop, their conversations and data that occurred when the station was not being tracked, and this was "dumped" down to a ground station when the station passed overhead.

NASA had to update Mission Control [MCC] in Houston to support the long-duration missions of Skylab. For the first manned mission (SL-2), MCC stations had four teams controlling twenty-four hours a day working forty-hour weeks. For the last two manned missions, however, they changed to five teams working five days and then having two days off.[4] For many of the controllers, this was a difficult transition. To a flight controller like Jane G. Mager, the main problem was that Skylab tended to break the family routine, which was extremely troublesome. Instead of working between seven and ten days two or three times a year, as in Apollo, they worked basically continuously for nine months.[5] This difference was, understandably, very difficult.

This major change made some of the flight controllers uninterested in the Skylab missions. For instance, Marlowe D. Cassetti's division chief, John P. Meyer, gave him no more than one hundred people to accomplish his tasks in Skylab, a change also because of budget. This was a great reduction in manpower from the glorious Apollo days.[7] Even so, Mr. Cassetti was pleased with the much improved tracking of Skylab when compared to the Mercury and Gemini days.[7] While it is true that there were more stations, from a handful to around twenty-one,[8] the tracking still needed improvement and refinement to attain the status for the current International Space Station.

Most of the high-profile Flight Directors from the Apollo days did not maintain their positions for Skylab. Many, like Gene Krantz and Chris Kraft, received promotions. According to M.P. Frank III, a Flight Director during both Apollo and Skylab, one of the biggest problems in MCC during Skylab was discipline and keeping focus. Apparently, some of the newer Flight Directors, namely Don L. Putt and Neal Hutchinson, required separation. At the same time, while there was an abundance of work to do in MCC during Skylab compared to the Apollo program, the mission presented spans of boredom for the flight controllers. Sometimes this routine left them not completely focused on their jobs.[9] Because of the way communications ran, during the times that the controllers and the orbiting station were not connected little could be accomplished and those controllers could grow tired and complacent. This certainly proposed a different situation compared to the Apollo missions.

Neal Hutchinson, meanwhile, attributes some of the harsh transition problems to the tight schedules carried over by MCC to Skylab.[10] During the Apollo missions, the men lived by a tight, set schedule because there was a limited amount of time on the missions. On Skylab, however, this regime of scheduling remained which left little room for error. These missions, however, were different because the crew needed more time allotted for certain activities like inventory. This took significantly longer than originally expected. These tight schedules would definitely hurt the image of the third and final crew.

NASA also had to change its approach to such essentials as hygiene, waste management, and eating, among others. A major psychological difference came from the change in a lengthy rather than a short trip. Lousma likened Skylab to a remote outpost to Apollo's camping trip, in that the Skylab astronauts were alone for weeks on end, whereas Apollo astronauts were alone only for about ten days.[11] The astronauts had to prepare for an extended stay together without a great deal of interaction with other people and the (literally) outside world. Certainly there is a major difference in the approach to the two drastically distinct programs, and all angles had to be reviewed.

A final difference between Skylab and earlier missions suggests that Skylab was "not suspenseful, like the expeditions to the moon, but a steady, continuous experience, like life anywhere."[12] To change that analogy a little, if Skylab were a year in school, an Apollo mission was a final exam. Or again, if Skylab were a baseball season, an Apollo mission was the playoffs. Baseball seasons are often described as a marathon rather than a sprint, another appropriate analogy. All of these are to say that Skylab became an everyday routine, where one day was spent like the next; whereas on earlier missions, each day was different for one reason or another. Each program had different specific goals, and NASA planned the missions appropriately to reach those goals.

TRAINING

By the end of 1966, a number of the astronauts who would later fly on Skylab were already part of the AAP office. The Administration named Alan Bean Chief of the AAP Branch in the Astronaut Office in August, and Owen Garriott Chief of the Experiments Branch in October.[1] Also working in the office was Kerwin and Gibson, among others.[2] By May of 1967, NASA handed technical assignments out. Among the Skylab crews, there included:

Alan Bean	Chief of AAP branch
Owen Garriott	Communications
Edward Gibson	Crew quarters layout and controls
Joseph Kerwin	Food, waste, and IVA
Jack Lousma	Activation and deactivation
William Pogue	Lighting and photography
Paul Weitz	Experiments, AAP 3 & 4

Also contributing were:

Joe Engle	IVA equipment
Bruce McCandless	Experiments, AAP 1 & 2
F. Curtis Michel	Hand holds, tethers, and foot rails[3]

Once the Apollo program began to slow down, the AAP office began to change dramatically. Before the end of Apollo, most of the astronauts not associated with those missions tried to train wherever they could whenever they could. For instance, in 1969, Gibson, Kerwin and Weitz were able to simulate an EVA in the water tank at Marshall. They simulated an ATM film canister replacement EVA,[4] something that would greatly help later Skylab missions. After his successful Apollo XII mission, Pete Conrad joined as the Chief of the (newly named) Skylab Astronaut Office in August of 1970.[5] This addition seemed to bring a little more credibility to the program with a clearly appointed leader. From then on, Conrad was "Sky King". All the astronauts knew that Conrad was in charge of the whole program from their perspectives, they could ask him for help and he would stand up to the Administration for them.[6] Certainly a program struggling for respectability and funding could use a man like Conrad who was very well respected in NASA.

Slightly earlier in late 1969 or late 1970, Deke Slayton announced the selection of astronauts for the Skylab missions. While he did not say who would be on what mission, they did have a better sense of the participants.[7] It was not until January 16, 1972 that NASA announced the official crew assignments (listed in Table 2).

TABLE 2: Crew Assignments

Flight	Prime	Back-up
SL-2	Conrad, Kerwin, Weitz	Schweickart, Musgrave, McCandless
SL-3	Bean, Garriott, Lousma	Brand, Lenoir, Lind
SL-4	Carr, Gibson, Pogue	Brand, Lenoir, Lind

Vance Brand and Don Lind would also train for rescue operations. Likewise, the back-ups would serve as CapCom, the flight controller who speaks with the astronauts.[8] Even though the official crew assignments were not made until this late, the astronauts would end up training together for approximately five years. Even so, now that they received official assignments, they could train more thoroughly as a complete crew.

For the first few years of training, the biggest problem was that the Apollo missions, still in progress, had precedence. The Skylab crews would have to fight for time on the trainers when they could. In all, the astronauts would receive around 2,150 hours of training before launch, including everything from equipment to exercise to briefings. While specialized training began in January 1972, it was not until November of that year that the simulators and trainers were linked up with MCC for complete training. While each member of the crew had specialties, each member received training in every aspect of the mission in the event of an accident or illness. Each even learned how to perform minor surgeries.[9] This cross training could prove essential for a successful, long-duration flight. The extensive training could also prove helpful for crew morale and simply getting to know each other. The longer they could work and train together, the better they would feel about working together. Another indispensable phase of the training did not even include the Skylab astronauts. NASA authorized the Skylab Medical Experiment Altitude Test [SMEAT] in December 1970 as a ground-based, 56-day simulation of Skylab.[10] The crew members, which included Bob Crippen as Commander, Bill Thornton, MD, as Science Pilot, and Karol Bobko as Pilot, experienced full training just like the real Skylab astronauts, only in condensed form.[11] The simulation itself ran from July 26, 1972 to September 20, 1972. The astronauts completed tasks just as performed in space, including all medical experiments. NASA drew some important lessons from this simulation. For instance, they found that the Urine Volume Measuring System was too small and leaked, something they needed to fix before launch. They also learned how to work together in a closed area for a long time. They had to stay on task to accomplish their tasks and overrule their disagreements.[12] SMEAT also saved the astronauts in Skylab from having too fixed a diet. Originally, for the medical experiments, the astronauts would all eat the same amount of calories each day. While theoretically this may be practical, in reality, every person has his own daily need. Some of the larger astronauts needed more calories while some smaller astronauts needed less. Thankfully for them, the doctors realized the truth behind the matter, and they tailored each diet to the individual astronaut.[13] This extremely important lesson proved invaluable to those who worked on the station. This type of simulation was vital to NASA for it gave an idea of what the astronauts might experience over an extended period of time in space. Certainly nothing NASA had done up to that point could compare to these simulators. These lessons, weighty or not, helped Skylab run smoother. By the end of SMEAT, most of NASA was ready for launch on their first space station.

SKYLAB I

The launch of the unmanned Skylab space station marked the end of an era. On May 14, 1973, NASA launched the last Saturn V, the workhorse of the Apollo program, and the largest rocket America ever produced. A typical Saturn V was 364 feet tall and weighed 6.1 million pounds. The first stage could generate 7.5 million pounds of thrust.[1] The Saturn V had used all of this thrust to reach the moon.

For Skylab, NASA modified the Saturn V. Since Skylab did not need as much power as needed to reach the moon, they converted the third stage into the Skylab workshop instead of the typical fuel storage tank as originally designed. A Lunar Excursion Module [LEM] also was not included. The Saturn V instead stood only 333.7 feet tall and weighed 6.2 million pounds.[2] A launch of a Saturn V proved a powerful example of man's scientific ability.

The dry workshop was a station converted from a third stage of the Saturn V rocket. For the first time, NASA engineers and scientists discussed the living conditions and habitation of a space vehicle.[3] Before Skylab, habitation had not been a concern for the missions lasted a relatively short period of time and living arrangements contained only the necessities. For the longer mission, however, the astronauts would have to live and work for an extended period of time, so a certain amount of comfort seemed logical. One addition that the astronauts continuously had to fight for was the window. By definition, a glass window immediately threatens the structural integrity of a space vehicle, especially one traveling at such speeds and bearing such amazing forces to leave the atmosphere. Engineers thought a window was too risky, but the astronaut office was adamant. In the end, NASA decided to add the window on October 31, 1969.[4] This struggle proved that NASA would listen to the astronauts' wishes to make the station more comfortable. Throughout the Skylab program, the merit of the window, both for entertainment and for research, was reaffirmed numerous times.

Skylab used the same Command Module [CM] as the Apollo missions, and this docked to the Orbital Workshop [OWS] of Skylab at the Multiple Docking Adapter [MDA]. The MDA measured seventeen feet long, ten feet in diameter, and weighed 13,800 pounds. This area housed control panels for solar observations and Earth observations, as well as spare parts and stowage. The Airlock Module [AM] was attached to the MDA, and measured approximately eighteen feet long, a maximum diameter of twenty-two feet, and a mass of 49,000 pounds. The AM contained the EVA hatch, which was actually a spare from the Gemini missions, and the Instrument Unit for the activation of the Skylab workshop. The main area of Skylab was known as the Orbital Workshop, which was a modified third stage of the Saturn V rocket. The OWS was forty-eight feet long, twenty-two feet wide, and weighed approximately 78,000 pounds. The OWS included the majority of the living area, including the sleeping and eating areas, most of the experiments, and the trash airlock. The Skylab with CM attached measured 117 feet long, weighed 199,750 pounds, and had a habitable volume of 12,700 feet cubed. The Apollo Telescope Mount [ATM] was located on the outside of the OWS, and was used for solar observations. The ATM included four solar arrays that would provide about half of the electrical power to the station, with the other supplied by the larger solar arrays located on the OWS itself.[5] These numbers can tend to be difficult to comprehend. The training module housed at Space Center Houston, in Houston, Texas, and the second Skylab station at the Smithsonian Institute in Washington, D.C. provide a better understanding about the size of the station. Pictures and words on page hardly can do justice to the engineering achievement.

At 13:30 EDT on May 14, 1973, Skylab lifted off into the heavens to orbit the Earth. Just seconds after takeoff, Mission Control in Houston, Texas, began tracking the station for the first of hundreds of afternoons. This afternoon was unusual, however, but not just because it was the last launch of its kind. After only about a minute in flight, Skylab was already in danger. At that moment, controllers knew that the shield to protect the Skylab deployed, well before it should have.[6] Events began to unravel quickly that would change the course of the mission.

Just sixty-three seconds into the flight, the force of the launch into space had prematurely deployed and ripped off the micrometeoroid shield. Then, approximately ten minutes into the flight, part of the solar arrays broke off and was unable to deploy correctly.[7] Since the shield was gone and the arrays would not fully stretch out, this caused many problems for NASA. The solar panels were not generating the required amount of energy. Until they fixed this problem, any crew living on board would have to operate at less then full power. The bigger problem was whether or not a crew was capable of living on board at all. NASA had also designed the shield to block the immense heat of the sun. Without this, the station quickly heated up. With no shield, the heat would make it almost impossible to inhabit; there was little to no protection against small fragments, micrometeoroids, that may impact with the station.

NASA notified the astronaut crews about the circumstance as quickly as possible, each of them in different ways as most had already left the launch site. Whatever the concern of others, Weitz maintains that he was confident that at least the first crew would fly, if only just to take pictures of the wounded station.[8] While some may have expressed concern that the mission was a lost cause and they would lose their chance to fly, Lousma had a rather optimistic approach. He says that after he heard about the problem, his reaction was that it could be worse, and that they just have to find a way to fix it.[9] What followed would be, perhaps, the most intensive, inter-center cooperation to fix a problem in the history of NASA.

Engineers and scientists from all over the space agency worked together to help solve the problem. Kerwin and Schweickart, among others, headed directly to the large pool at Marshall to work on the various options proposed. They resolved to test each one in the near-weightless environment. Meanwhile, they also had to find out how to fix the solar array problem. Fortunately, on May 22nd, Weitz demonstrated that he could free the array by releasing the debris in a method comparable to using a large pair of garden sheers.[10] After days of endless trials in the pool, NASA officials agreed on both temporary and permanent solutions, giving clearance for the first crew, SL-2, to go. A final schedule revision placed the launch of Conrad, Kerwin, and Weitz for May 25, 1973.

SKYLAB II

The Saturn 1B rocket is like a miniature version of the large Saturn V. The Saturn 1B was a two-stage vehicle, rather than three-stage. It also was only 223-feet tall, so for the three Skylab launches, a 127-foot tall "milk stool" brought the vehicle up to the appropriate height for the tower built for Saturn V rockets.[1] A Saturn 1B when fully ready for launch, weighed around 650 tons.[2] While slightly less impressive compared to its behemoth cousin, the three launches sending a total of nine men to Skylab must have been amazing enough.

Skylab 1, SL-2, launched on May 25, 1973 at 9:00 in the morning.[3] The three astronauts visually checked the workshop before docking. With great conviction, they reported that they could, indeed, fix the problem. For their first EVA, Weitz hung out of the door of the CM while Kerwin held his feet and Conrad flew the vehicle. Unfortunately, this attempt to free the solar array was unsuccessful, so the crew had to quit for the day and, instead, dock to the station.[4] Their first attempt proved to be more difficult then first believed. Although they had trained extensively in the large pool at Huntsville, reality proved more challenging than conceived.

The next day, the crew entered Skylab. Without the pivotal shield, the temperature was a rather warm 130°F. Therefore, they engaged in their next job, the deployment of a temporary parasol that would act in the shield's stead. Though they could not work non-stop due to the heat, by the end of the day, they had successfully deployed the parasol about two-thirds open. Overnight the temperature dropped to a more agreeable 90°F.[5] Although not yet at the optimal temperature, it was enough to let the astronauts continue to work the next day. The workshop would eventually cool down to the desired temperature.

The crew spent much of their first week or so dealing with storage and inventory, while also growing accustomed to the layout of Skylab and a typical workday with the many experiments. On June 7th, the astronauts were finally allowed to attempt another EVA to fix the solar array. Conrad and Kerwin would leave the station, with Kerwin doing the actual cutting. After three hours and twenty-five minutes of hard work and gritty determination, they freed and deployed the array.[6] With this accomplished, the crew was able to return to normal, full-scale work. They were determined to work much harder in the final two weeks to make up for the time spent in the first two weeks both fixing the station and generally not working at a full pace due to the initial setbacks.[7] Indeed, this first crew constantly spent time fixing or repairing problems on the station. As a result, they could be called the "Astronaut Repairmen", as they were by *National Geographic*.[8] This label would be true of all three crews, as sometimes it seemed as though something always had to be fixed. This same determination and pride in their work continued with each crew. In the end, NASA could see that they definitely made the right decision when picking these crews, for no one could accuse any of the mission members of working less then as hard as possible.

A normal day consisted of many tasks. Even when the station was not at full strength before they fully deployed the solar panel, the astronauts still accomplished as much as possible. Each day, the astronauts would exercise, complete all their medical requirements, work on the ATM with solar studies, and do housekeeping chores.[9] Since they had trained together as a crew for almost three years, they worked together very well. They treated each other as friends, but they also knew that Conrad was still the commander, in charge of the mission. If Conrad and Kerwin argued, Weitz was there as a stabilizing factor.[10] Perhaps one of the elements that helped them get along so well was their common Naval background. They also knew that they were there to do a job; they had to work together to complete the mission successfully.

The first crew never asked for extra work. They did this purposefully, for they did not want to ask for too much and then have the Flight Controllers add too much work for the next crew.[11] They had free time, and like all three crews, they spent the majority of their free time looking out the window at the Earth. Sometimes there were even all three astronauts at the window looking down, with bodies in three different directions.[12] Apparently, most of the astronauts felt as though they did not know their geography as well as they should, but a chart on board the station defining their location proved helpful,[13] even if they may not have enough time to see exactly where they were. The astronauts had other means of passing their free time available, but none appealed to any of the crews as much as the window.

Another important development revolved around communications between the astronauts and their families. Before Skylab launched, the issue of whether or not to let the crew have private conversations with their family surfaced. The astronauts wanted private talks, but the media fought against it, afraid that they would say something important and they would miss an important story. Since NASA decided against it, the first crew said they would not talk if it could not be private. For the second and third crew, however, the guidelines were relaxed, and the astronaut and his family was allowed to talk together with one "trusted NASA" employee listening in and reporting anything out of the ordinary. While the media in general did not like this, they had to concede, and they never reported anything.[14] Fortunately for the astronauts, NASA changed its mind, probably as a result of the first mission's successful completion. Sometimes it is better that the media can not access everything.

About a week before the crew was scheduled to come home, Mission Control asked the astronauts if they would not mind staying up in space an extra week. At that time, due to budget cuts, NASA was still unsure if the third crew would fly a mission; they wanted to get the most data and results out of the station. While the SL-2 crew wanted to fly home on time, for space could not compare to the comforts of home, Conrad assured Houston that they were willing to help out any way that they could. Luckily for them, a day or two later, NASA confirmed the third crew mission. The SL-2 crew could leave on the 28th day as planned.[15] The idea that the crew would not want to stay up longer seems unusual since many people would pay, and some have, to be able to spend time in space. The other two crews did not seem to mind staying up for fifty-six and eighty-four days respectively; perhaps this feeling of longing for home was confined to just these three astronauts.

The last few days before leaving, the crew prepared the station for departure and stowed away objects. They undocked from Skylab at 3:58 A.M. By 8:49 A.M., their Command Module was bobbing in the ocean waiting to for pick up. Conrad, Kerwin, and Weitz had set the endurance mark at twenty-eight days, forty-nine minutes, and forty-eight seconds, with a total of four hundred and four orbits.[16] They had fully doubled the previous record. They successfully fixed the station so that it would survive the duration of the missions. Overall, Skylab 1 was a most successful mission.

SKYLAB III

A little over a month after the first crew had returned, the second crew, Skylab III, had finished training and was ready to launch. The first crew had spent a few weeks after their mission finishing the medical experiments and debriefing. NASA passed on the information from those meetings to Bean, Garriott, and Lousma, in order to help them have a more efficient mission.

Skylab III, in their Saturn 1B, lifted off at 7:10 EDT on July 28, 1973. It only took them a little under 10 minutes to reach orbit.[1] Soon after they were visually observing the station. In fact, they docked nine hours after launch and actually entered the station only two hours later.[2] They were able to dock and enter much quicker then the first crew because they did not have to worry about an EVA before docking and activating the station after docking as the first crew did. Unfortunately, the mission soon would slow down to almost a crawl.

Whereas the first crew was not bothered by any major sickness, the second crew was completely hampered by illness. The entire crew became sick almost immediately and fell behind schedule. Instead of trying to continue their routines, and working with the illness, NASA gave the astronauts permission to rest for the first 3 or 4 days. This actually gave the Flight Surgeons a chance to study the space sickness.[3] After this rest period, the crew felt much better. Perhaps due to this slow start, they became an extremely efficient and hard-working crew.

Just a few days later, on August 2, alarms started showing that something was wrong with the Command Module. The CM was leaking fuel. Alan Bean also had reported this just a few hours into the mission, but little attention had been paid. As a precaution, NASA began prepping Brand and Lind for a rescue mission, readied by September 5th. In their simulations, however, the two showed that the crew could successfully return without harm; and, in effect, talked themselves out of the chance to fly.[4] Even though it was not needed, the fact that they were ready to go proved that a rescue plan was necessary for such a mission. The two worked extremely hard and, in their own way, saved Skylab again.

Garriott and Lousma attempted the first EVA to install the permanent shade on August 6th.[5] The original plan was for the EVA to take three and a half hours; but, due to unforeseen difficulties, they were out for six hours and twenty-nine minutes, a full three hours longer than planned.[6] This new shield had immediate effects, lowering the temperature even more to room temperature. This, once again, showed that activities tended to take longer in space then they did in simulation. The astronauts of Skylab fell behind schedule so often because of unrealistic goals and expectations set by the Flight Controllers.

The crew of Skylab III included very different personalities then the first crew. While Lousma and Garriott tended to love acting in front of the camera, Bean, the commander, was always trying to do more.[7] The commander remained highly motivated and focused, and Lousma stood out as a "conventional Marine," staying loyal and friendly with the will to complete the job.[8] The first crew maintained that they made sure to eat all their meals together to keep the human contact.[9] This crew, on the other hand, rarely ate together, especially lunch. As Lousma said, since they were always rushing to work more and accomplish more goals, "things you needed to do the most to prolong your life…were the things that got the least priority: eating on time, sleeping on time, exercising on time."[10] They were extremely dedicated to their work, and so they sometimes overlooked the most important concerns.

Even so, the crew found time to have some fun. One day, when Bob Crippen was CapCom, he heard a woman's voice calling him from Skylab. The voice identified itself as Mrs. Garriott; she had brought some things to the crew. She also mentioned that the California wild fires, taking place at that time, looked amazing. She then said that she had to go because someone was approaching the Command Module, where communications took place. Crippen went along with it, and told the other controllers what had happened. It was not until the 25th Anniversary of the flight that Garriott explained they had recorded it before the flight, adding Crippen's name and the California fires to make it seem more realistic. He also explained that Crippen knew about it. They had actually made a number of variations on tape using different natural events, playing the correct one depending on what was actually happening.[11] The amazing thing about it is that most of the Flight Controllers did not understand how that joke had been played until twenty-five years later. Jokes like this showed that they could have a good time while still working almost non-stop.

By the end of the mission, the crew had accomplished one hundred and fifty percent of their goals,[12] a remarkable amount considering all the problems with which they started. The crew returned on September 25th, fifty-nine days, eleven hours, and nine minutes later. They set a number of records, including single mission endurance.

Alan Bean accrued the most amount of time in space, a full 1,671 hours.[13] Perhaps even more important, they proved that man could last in space for that long a period of time. They also came back relatively healthy, even more so then the first crew. One can attribute much of their health to the exercise regime. At this time, Skylab would fly unmanned once again, waiting for the third and final crew to arrive setting even more records and accomplish even more research.

SKYLAB IV

The final Saturn 1B to Skylab launched on November 16, 1973 at 9:09 EST.[1] Many surprises filled the weeks between the second and third crew. Astronomers had observed a new comet in March that would achieve its perihelion (closest to the sun) on December 28th. NASA felt that this would be an exciting phenomenon, adding perhaps a once-in-a-lifetime chance to observe a comet above the atmosphere with astronauts and all the equipment on board the Skylab. As a result, in April NASA pushed back the launch of the third crew to November 9th, and again delayed it to the 11th, thus giving time for the appropriate training.[2] Surely, the astronauts wanted more training on their docket, especially an all-rookie crew.

More trouble was on the way. During a routine inspection of their Saturn 1B rocket on November 6th, just five days before the scheduled launch, NASA employees found cracks on the fins. The administration quickly set workers to replace them. A week later they finished replacing all eight fins.[3] One reason given for the cracks was the delay in launch from when NASA readied the rocket months earlier for the possible rescue mission; there was simply too much weight on them for too long a duration.[4] Keeping in the true tradition of Skylab, the final mission already dealt with problems before it even launched. This would not be the end of the problems.

Shortly before the launch, Gibson jokingly called their Saturn rocket "Old Humpty Dumpty" due to the necessary repairs, and some members of the media reported this statement. This angered some of the NASA employees, and they made sure that the astronauts knew how they felt. But around twenty minutes before the launch, the ground called the astronauts waiting in the CM and wished them "Good luck and God speed from all the king's horses and all the king's men."[5] Evidently, the workers forgave them and, indeed, liked the joke. Such levity was reminiscent more of Bean, Garriott and Lousma then Carr, Gibson and Pogue.

The crew spotted Skylab about seven hours into the flight,[6] and soon docked. Not long after, Pogue began to feel nauseous and vomited. Carr and Gibson worried that if Mission Control found out, they might stop the mission early, and surmised that Pogue would soon feel better. As a result, they decided not to say anything to the MCC, and just continue on as if nothing happened. Unfortunately for them, they did not know that their conversation was taped, and was soon downloaded to the ground. When the NASA officials found out what had happened, they were very upset with Carr's judgement. Deke Slayton publicly reprimanded him.[7] The incident was not as simple as it sounds, however. Unlike the earlier commanders Conrad and Bean, Carr was a rookie. As such, he did not have the reputation nor the respect that the other two already garnered with the Flight Controllers. The crew, however, rookie or not, certainly made a bad judgement call to choose not to tell MCC about the illness. The crew definitely felt remorse for their less than forthright decision.[8] Nonetheless, the incident left a negative mark on the crew, one difficult to overcome.

When the crew finally entered Skylab, they found three dummies stashed around the station left by the earlier crew, still more testament to the sense of humor of the second crew. That crew had worked at an amazing pace, completing, as noted before, one hundred and fifty percent of the mission goals. What Mission Control forgot, however, was how slow the mission had begun. As a result, the controllers started the third crew, from early on, with unrealistic schedules. The crew almost immediately fell behind, and Carr began to complain about the overload.[9] Carr, Gibson, and Pogue remained on an impossible pace for the first six weeks and then finally requested a rest, talking the situation over with the ground. From then on, the crew and Flight Controllers had an understanding; the schedule slackened off slightly.[10] In retrospect, for the first six weeks a great deal of hostility appeared to exist between the men of Mission Control and the three in Skylab. Most of this probably stemmed from the fact that Carr was inexperienced and felt overburdened with work. Perhaps Conrad could have dealt with the illness situation better if he had more experience, or at least, the Flight Controllers would have listened to him and respected his viewpoint.

The *New York Times* ran an article declaring the third crew "lethargic". The paper quoted officials saying that they were studying the lethargy of the third crew, and whether or not it could be fixed. They complained that they did not want to work on their day off. The controllers said that they had to lessen the workload, which was true, because they could not keep up with it. The paper basically said that they did not work as hard or as well as the first two crews.[11] Only three days later, the paper published a report that officials were "pleased" with the crew.[12] It seems as though the media wanted this crew to fail, for whatever reason.

Skylab IV is, by far, the most controversial of the missions. Henry S.F. Cooper, Jr. wrote *A House in Space* in 1976 about Skylab. While he touched on all three missions, he focused on the crew of Carr, Gibson, and Pogue, and their seeming insolence. He was sadly mistaken, and completely inflamed many of the conflicts surrounding this particular mission.

When Dr. Kerwin referred to the book, he said that many of the details were "wrong."[13] This was my first encounter with the book, although I had seen it mentioned before. Almost from the first pages, Mr. Cooper seems to have violently attacked the crew. He said that, "Flight controllers and others at the Space Center...openly talked of them as being lethargic and negative."[14] Again, "Gibson...had a square jaw that apparently never stopped moving the whole time he was in space" and he "was perhaps the contrariest, bitchingest astronaut that ever departed vertically from Cape Kennedy, and his two crewmates were in the same category."[15] Of the other two, "Carr and Pogue grew thick, revolutionary-looking beards aboard Skylab...which, combined with the blistering language from the space station, made them [the flight controllers] uneasy."[16] Finally, "the remarks of all three members of the third crew continued to have a barracks-room grumpiness from the beginning of the mission to the end."[17] Each of these are just a sample of the openly hostile remarks made against the third crew. He even includes an underlying message that the "revolutionary" beards made those in MCC apprehensive because those beards did not conform to the "clean-cut" image of NASA and could even be likened to the Soviets in Russia. At this time, the Cold War still dominated the country, and to even imagine such an American icon resembling Communism would make anyone "uneasy". A suggestion like this was much more grave at the time that the book was published then in today's world. To make matters worse, the author rarely ever backed up his arguments, except to say that this negativity grew from their concealment of Pogue's sickness.

One must understand that each of the crews was asked beforehand to tell the truth about the habitability. They were supposed to be critical, telling how things could be better. Each crewmember could find something to complain about. When Lousma spoke out against the lids on the food, Cooper remarked that he "at times sounded like a member of the third crew."[18] That was an unfair, disparaging comment that had no basis of truth. Lousma was doing his job, telling the NASA officials what he thought about the lids. Not only was he rebuked by the author, but the third crew as well.

Interestingly, though, he seemed to change his mind about the crew farther along in the book. He stated that the third crew "griped" and "made so many mistakes and fell so far behind," but there was "nothing seriously the matter with the astronauts at all." Instead the problem "lay with the ground itself" because they "started these astronauts off at too fast a pace."[19] Indeed, Cooper blamed the Flight Director Hutchinson for any problems because he pushed the crew thinking they were lazy.[20] This is quite an interesting attitudinal reverse on the part of the author. The reader hardly knows what to believe: was the crew really that bad, or could one blame tensions and dissension on the Flight Controllers in Houston?

Another issue about this flight was the so called "Space Strike". Around the sixth week in Skylab, the crew said that they needed a day off to rest; they also wanted to talk things out with the controllers in Houston. Everything seemed to be worked out, but the astronauts also decided that only one of them would talk to the ground at any one time. During one whole pass over the United States, they forgot to turn the radio back on, not realizing it until later that they had not heard from Houston. The media heard about this and dubbed it the "Space Strike", saying that the astronauts were non-cooperative. Cooper also mentioned this in his book. Dr. Gibson took offense to this because Cooper, and other media members, never actually spoke to the astronauts about the so-called strike. Cooper, in fact, took everything from the communications tapes.[21] Almost all that the author wrote in his book came solely from those communications. That is not to say that the communications cannot be used in scholarly works. Indeed, they should be, since they contain the exact words without any interference. To use them exclusively, however, can lead to trouble because only using one source for a work will always make it biased, and the total lack of an correspondence with the people in the events means anything could be taken out of context. Consequently, without actually speaking with those who took part in the events, how could Cooper arrive at a clear and accurate picture?

Other sources, such as more recent publications like Shayler, corroborate that this crew had problems, perhaps more so than the first two, but few came out as extreme as Cooper. While the crew certainly struggled at the beginning of the mission, this can mostly be contributed to the less than admirable start to the mission.

After the incident of hiding Pogue's sickness, many media members seemed to want to make them out to be "bad guys." For the most part, they were doing their jobs by complaining about conditions on board Skylab. The amount of complaining, however, probably went too far and damaged their reputation. The imagined "Space Strike" event, however, did nothing to help their standing in the eyes of many critics. NASA, however, stood by the astronauts and allowed them to complete their record-breaking mission.

Despite all the problems, one may suggest that this final crew was the most productive of all, accomplishing even more than the crew of Alan Bean. Simply on percentage of time alone, the third crew spent around forty percent of their time on experiments, the second crew almost thirty-nine percent, and the first crew almost thirty-eight percent. That slight percentage difference is made even greater when physical training is factored in, since the third crew spent a full percentage point more time on physical activity than the second crew, and over three percent more time than the first crew.[22] Each crew spent more time on experiments generating more output. The third crew easily spent the highest percentage of time on research and outperformed the first two crews (full table found in Appendix A).

On January 11, 1974, NASA told the crew that they would, indeed, stay at Skylab for the full eighty-four days. This meant that, after forty-eight days, ever day, every hour, every minute that they stayed in space was another record. On February 3rd, Carr and Gibson departed for the final EVA of Skylab, this time a five hour, nineteen minute long spacewalk to collect all the samples and film from outside the station. Just before leaving, the crew boosted the station up more in an effort to help it last into the 1980's. They also left a few resources in the station in case NASA scheduled another mission, perhaps with the planned Space Shuttle, to redock with Skylab. On February 8th, they finally left Skylab, flew around taking more pictures, and landed in the ocean only five hours later. The mission had lasted a total of eighty-four days, one hour, fifteen minutes, and thirty-two seconds, easily a record at the time.[23] Behind them, they left a legacy of science and research. Man had learned, time and again, how to work through adversity. Each mission had had its share of trials, and each presented NASA in a favorable light.

SENSATIONS

The third crew awoke at 2:00 A.M. on the day of their launch to ready for the experience. After breakfast with such NASA notables as Deke Slayton and Al Shepherd, they suited up before arriving at the launch pad. Before heading into space, they passed by and saw one last time many of the members who had helped the mission in some way. To Gerald Carr, the Commander, the launch felt like "a train with square wheels", with an abundance of noise and vibrations.[1] To the Scientist Astronaut, Dr. Edward Gibson, the ignition was like being in a tall building during an earthquake. The flight training helped him to trust that everything would conclude successfully. He also remarked that the turbulence felt like "being a fly glued to a paint shaker."[2] All three crews experienced similar feelings. To many on the ground, the event holds a great place in their memories. To the astronauts in the rocket, it was an experience of a lifetime.

Weightlessness can lead to a variety of reactions. The best known is motion sickness, something that all three in the second crew and Pogue in the third crew had to fight. Some lesser-known sensations are also prevalent. Carr complained that he felt constantly congested because the fluids in his body pooled in his head. He was, understandably, annoyed.[3] Weitz may have had the most drastic reaction of all. The beds in Skylab were rearranged such that the crew slept "on the wall". This sensation is purely mental, because in space no "up" or "down" exists. To Weitz, however, the feeling was unbearable, so he moved his bed nightly to sleep "on the ground". Each day he had to move it to its rightful spot so that it would not interfere with the day's activities.[4] This remarkable behavior did not reflect on any of the other astronauts on Skylab. One other effect of weightlessness for an extended period of time was that Pogue remarked that he felt as though he weighed "a ton" when he returned.[5] After being free to move around for so long, once back on Earth and limited to walking, gravity made him feel weighed down. Perhaps this was due more simply to the fact that he could not float anymore. Reading or hearing about these many interesting sensations from microgravity allow the layman the ability to better grasp a feeling that he probably will never experience. These unusual circumstances effect each body slightly differently.

On a typical day aboard Skylab, the three astronauts awoke at 6:00 A.M. They then dressed and shaved before eating breakfast around an hour later. After breakfast, one of the crew would head to the ATM for solar observations, while the other two dealt with other experiments, such as medical or maneuvering units.[6] The average crew member spent one to one-and-one-half hours on the exercise bike each day, but each crew increased their amount (data found in Appendix A).[7] Meanwhile, the crew would conduct solar viewing through shifts throughout the day, stopping for lunch when they could. When all the work was done, they could attend to a "shopping list" of experiments or repairs needed to successfully complete the mission. All would stop for dinner around 6:00 P.M., after which the crew dealt with household chores and reviewed the next day's schedule which Mission Control sent up on the printer. In the evening, they had some time for recreation, and generally each would have a private conversation with the Flight Surgeon to discuss the medical experiments and any healthy issues.[8] While a typical day may not seem very exciting, enough activity kept the astronauts busy and closer to reach their goal of a successful mission. Many times, of course, something interrupted the day, such as an EVA or a necessary repair. NASA truly tried its hardest to get the most out of their investment.

One hallmark of the Skylab missions was the abundance of Extra-Vehicular Activities, or EVA's (a full list of EVA's found in Table 2). Spacewalks tend to remain with astronauts as a lasting memory beyond most other aspects of missions. Many have described them in amazing and memorable ways. With so many taking place in just three missions, surely the nine astronauts of Skylab could help a lay person understand the beauty of stepping out of a space vehicle.

Paul Weitz wanted to experience a real EVA, not just his standup EVA at the beginning of the mission. He asked if he could participate on the last one of the first mission. Kerwin agreed, as did everyone else, and Weitz got his wish. Although he says he did not have a chance to appreciate the opportunity,[9] he still could say that he was out there, fulfilling his request.

Owen Garriott describes a most beautiful memory during his EVA, of looking down on the Earth. Skylab was passing from the Pacific Ocean over South America, and he could see from the southern tip up to Peru, all the Andes Mountains, and on to the Atlantic Ocean on the other side.[10] Moments like that will never be forgotten. An astronaut experiencing it can only hope to convey the image and his feelings. On the same flight, Jack Lousma said that the main difference on the EVA was that the Earth looked two-dimensional when inside Skylab, but when on the spacewalk, it was truly three-dimensional. He said it was "like gliding along on this magic carpet."[11] Lousma also said that standing on the end of Skylab was "like being on the front end of a locomotive as it's going down the track."[12] It was so breathtaking, in fact, that he confessed that he hated going back into Skylab after the spacewalks.[13] These two astronauts, on perhaps the most busy of the missions, still found time to appreciate the opportunity of a lifetime. Most people can only dream of such phenomenal sights.

TABLE 3: Skylab EVA's

Date	Astronauts	Purpose	Duration
5/25/1973	Weitz	Stand-up EVA	0:33
6/7/1973	Conrad and Kerwin	Free Solar Array	4:31
6/19/1973	Conrad and Weitz	Replace ATM film	1:37
8/6/1973	Garriott and Lousma	Deploy permanent heat shield and ATM film	6:31
8/24/1973	Garriott and Lousma	Replace ATM film	4:30
9/22/1973	Bean and Garriott	Retrieve parasol sample and replace ATM film	2:42
11/22/1973	Pogue and Gibson	Replace ATM film	6:33
12/25/1973	Carr and Pogue	Replace ATM film and photograph comet	6:51
12/29/1973	Carr and Gibson	Retrieve micrometeoroid shield piece and photograph comet	3:30
2/3/1974	Carr and Gibson	Collect all samples and ATM film	5:19

A final thought about the EVA's is what it must be like to be afraid of heights but yet above the world, looking down. As Garriott said, looking down what is known as the "elevator shaft", a 435 kilometer drop, "is the deepest elevator I've ever looked at."[14] Edward Gibson, on his EVA, put his feet in golden shoes on the telescope tower that were foot restraints. He said that when he leaned back, it felt as though gravity was going to pull him down, as it would on Earth.[15] It is hard to imagine the feeling, especially if one is afraid of heights. It must be a mixture of a "rush" and sheer terror.

Perhaps the astronauts' fascination with EVA's stems from their love of looking at the Earth out the window during their free times. In fact, only Alan Bean did not show enjoyment at looking through the window.[16] All the others seemed almost spellbound, that if they had the chance they would simply look at the Earth the whole time. As Dr. Kerwin said, they were "getting your geography lesson in your great trip of trips."[17] Many astronauts, such as Weitz, also talked about seeing the Earth in a new light. From so high up, no borders were visible.[18] It was just one Earth. They mentioned that if more people could experience it, perhaps minor problems between countries, which included conflicts in Vietnam and the Middle East, would die out and people would look at it as one land for all mankind.

FROM SKYLAB TO THE SHUTTLE

NASA discussed the possibility of returning to Skylab only for a short time. They soon deemed another visit to reboost it for a better crash landing with the Earth too risky and too complicated.[1] There was also talk that after the new Shuttle was ready to launch, a crew would rendezvous with the station. For this mission, the Administration picked Fred Heise and former Skylab astronaut Jack Lousma.[2] Ultimately, the discussion would become moot as Skylab came down years before NASA fully completed the Shuttle.

NASA built a second Skylab, Skylab II or Skylab B. Plans developed to launch it, until the Administration cancelled the program in August 1973,[3] presumably due to budget and a wish to move on to the shuttle. Garriott thought this was a mistake. He mentioned that the second Skylab could have allowed even longer duration flight. Since this did not come about, the second best place would become its resting-place, the Smithsonian in Washington, D.C.[4] Since this did not launch, one can only guess what another manned crew could have accomplished. It is amazing to think that all the hardware was made yet it was never used. Such are the facts of working with government.

In February of 1978, Flight Controllers working in Bermuda regained some communications with the dying space station. They frantically moved to many centers across the world over the next summer, only to find out that, in December, NASA cancelled the mission to revisit Skylab.[5] Now all that was left for controllers was to wait trying to predict where it would land. They also had a small amount of power left in the station to try to reposition it for a better landing.

On July 12, 1979, Skylab met the Earth. The decaying orbit sent the station falling down over the western portion of Australia into the surrounding waters, slightly off the predicted fall. Luckily for everyone involved, pieces landed only in sparsely populated areas of a friendly nation. Skylab had completed 34,980 orbits and left a debris field 40 by 2,400 miles. Collected pieces went to NASA for examination.[6] A casual observer can now find pieces of it on eBay, occasionally.

After Skylab, NASA moved on to the nine-day mission of Apollo-Soyuz, in which Vance Brand (Skylab backup and rescue astronaut) and Deke Slayton (of the Original Seven) finally flew in space.[7] For NASA, however, the future lay in the new, reusable, Space Shuttle. In fact, some engineers and scientists tried to move straight from Apollo to the Shuttle project, thinking that anything else was a dead-end and a waste of time.[8] The new Shuttle brought some of the public interest back since NASA was again seen as on the cutting-edge.

Of the nine Skylab astronauts, only Owen Garriott, Jack Lousma, and Paul Weitz would fly in space again, this time in the Shuttle. Weitz maintained that he went through the same basic training for both Skylab and the Shuttle, that not much had changed.[9] Garriott said that while the launch of the Saturn rocket and the Shuttle were relatively the same, the reentry was completely different.[10] Of course, for Skylab they landed in a capsule in the water, whereas the Shuttle lands like a glider on a runway. On the other hand, Lousma indicated that the launches were actually very different. The Saturn rocket was a stop and go launch because of the stages, but the Shuttle was a continuous movement out of the atmosphere.[11] Obviously there were some major changes between the two projects, but each seemed to adapt well to the new format. Such adaptations are the key to survival at NASA; but, for the time being at least, the Shuttle was here to stay. The days of the one-shot-only spacecraft were gone for good.

LESSONS LEARNED

Skylab, from the beginning, was designed as a program that would lead to other projects for NASA. Since the main objective of Skylab was science and research, many of the outcomes focus on those two fields. The space station naturally led to ground-breaking achievements and new ways for NASA to run missions for the future. A few of the most important are highlighted here.

For the first time someone other than CapCom talked to the astronauts while they flew in space. At one point in the third mission, Dr. Robert M. McQueen spoke with Gibson about one of the experiments.[1] While this sort of interaction had never occurred before, it now seems common place. The relationship between scientists and astronauts grew much better during the missions. Before they flew, those in charge of experiments tended to doubt whether or not the astronauts could complete the experiments correctly. By the end, the scientists seemed surprisingly pleased with the dedication of the astronauts and even thanked them for their hard work.[2] Indeed, Dr. Kerwin felt as though they were not guinea pigs, but rather co-investigators.[3] Probably the most skeptical of all scientists participating in this mission were the solar astronomers who did not want the astronauts to be in charge pointing the ATM at the sun. In the end, however, Cooper acknowledges that the scientists "were delighted at the way every time anything interesting occurred on the sun...the astronauts had focused on it."[4] Perhaps this relationship changed for the scientists and experimenters once NASA began accepting scientist astronauts and truly striving for research in space. Certainly the hard work and commitment to their work helped cement this affinity.

When asked what were the most important contributions of Skylab to NASA, the astronauts answered in a variety of ways. Carr maintains that they helped greatest in the field of medical studies, especially by living for an extended period of time in microgravity.[5] Kerwin stated that they aided most "the habitability, the diet and exercise, and the workday structure" for any future missions such as the International Space Station.[6] Garriott listed such contributions as the solar observations, long duration weightlessness, the importance of exercise in microgravity, and the idea that artificial gravity may not be necessary for future missions to places like Mars.[7] A variety of important discoveries came from America's first space station. With Skylab, NASA also realized that it could perform meaningful programs on a smaller budget.[8] Through the Apollo program, the United States Government had allocated almost any amount of money and resources needed for reaching the Moon. This level of spending still has not been matched. This ability to work on a tighter budget would become critical to the space agency.

During Skylab, the different NASA centers around the country also had to learn how to communicate more efficiently and work together to accomplish their goals. After NASA learned of the problems during the launch of Skylab, many of the centers pulled together to learn how to fix the accident. Certainly, Huntsville and Houston gain the most recognition for the work, but many of the others contributed as well. As some Skylab personalities, such as Garriott and Kerwin, have said, the amount of cooperation has never been matched. Garriott called it "sort of the golden era" of inter-center cooperation.[9] Of course, the amount of interaction ranked higher than any previous program from the beginning, as the project originated at the Marshall Center in Huntsville but had to also work through Houston and Cape Canaveral. Today's amount of communication and cooperation may not be as remarkable as it was during Skylab, but it certainly can be considered more efficient than before the space station.

CONCLUSION

While the Skylab missions themselves only lasted almost a year, the effects are long lasting. Enormous amounts of material came from the numerous scientific experiments and other research aspects of the mission. Likewise, the ability of the astronauts to criticize flaws and make suggestions for the future led to more productive missions. The men went on to take part in many organizations, but generally they stayed close to the space agency. NASA even asked some of them for help when designing the International Space Station. Above all, these men showed that people could last through long duration missions in microgravity. Through dedication to reach a goal and teamwork, they successfully completed what should be the first in a long legacy of human long duration endeavors into space. These men, from various regions of the country with different backgrounds came together to make a lasting mark on America's space program. Hopefully everyone can see that these missions were not wasted ventures, but rather gave more understanding of the human condition. May humanity never lose its zeal to conquer the invincible and study the fascinating.

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APPENDIX A

HOURS FOR EACH MISSION

Activity	Skylab 2 Hrs.	Skylab 2 %	Skylab 3 Hrs.	Skylab 3 %	Skylab 4 Hrs.	Skylab 4 %
Medical	145.3	7.5%	312.5	8.0%	366.7	6.1%
Solar Observations	117.2	6.0%	305.1	7.8%	519.0	8.6%
Earth Resources	71.4	3.7%	223.5	5.7%	274.5	4.5%
Other Experiments	65.4	3.4%	243.6	6.2%	403.0	6.7%
Sleep, Rest	675.6	34.7%	1224.5	31.2%	1846.5	30.5%
Pre/post Sleep, Eating	477.1	24.5%	975.7	24.9%	1384.0	22.9%
Housekeeping	103.6	5.3%	158.4	4.0%	298.9	4.9%
Training, Hygiene	56.2	2.9%	202.2	5.2%	384.5	6.4%
Other (EVA)	232.5	12.0%	279.7	7.1%	571.4	9.4%
Total	1944.3		3925.2		6048.5	

From: Skylab Statistics. Kennedy Space Center. http://www-pao.ksc.nasa.gov/kscpao/history/skylab/skylab-stats.htm.

APPENDIX B

Interview with Dr. Joseph P. Kerwin

December 29, 2003 11:20 a.m.

Johnson: I would like to begin by asking, if you could explain your relationship with Mr. Conrad and Mr. Weitz.

Kerwin: Well, Mr. Conrad was the commander and he was the boss and Mr. Weitz and I both reported to him. The astronaut office and, in fact to some degree the Manned Spacecraft Center in the sixties was set up in more of a military model then perhaps is today. The chain of command was pretty clear. That didn't mean that communication wasn't free because it was. But, when it came to direction, it was always pretty clear who was in charge. So, our relationship with Pete was that Pete was "Sky King". [chuckles] That was his nickname. He was the "king" of Skylab for not only our crew but for matters of policy and major decisions. All the flights would have to clear a position with Pete before we laid it on the other parts of the organization. Obviously, being on the crew you were just one part of a large organization and the rest of the organization was in many respects more important than you were. Skylab was a Marshall Spaceflight Center program. They were the lead center for Skylab. That was a bit unusual because Skylab was a human spaceflight. But what happened was that [Werhnur] von Braun who lead Marshall had always been a space station believer. All of his long ranger plans and scenarios for human space exploration had a space station as a major element, and when he was assigned to developing the Saturn boosters, Marshall was the big booster center. He kept on thinking that the Saturn V booster could be used as a prototype space station and he kept pushing those plans. And I remember early in my tour here in Houston in 1966, Al Shepherd told me to go to a meeting. Some Marshall guys were coming in end they had an idea for using the Saturn V S-IV-B stage as a workshop and so I went to the meeting and sat in the back of the room and listened to the [unintelligible] and it was the Marshall guys saying this is how we need to do this. The volume is right, you can send a command module up to dock and do things like that and the Houston guys basically said, "You know we're very busy going to the Moon here in Houston, why don't you come back later?" [laughs] And so the Marshall guys put their papers back in their briefcases and left the room and their parting shot was, "This is going to happen, you know. You guys really should be paying attention." And it did. Marshall got the lead center role. Houston, obviously, still provided the crews and did the training and did the mission control operations were done from here, but the design and development of the spacecraft and all the science were the responsibility of Marshall, all the science except the medical stuff. The human medical stuff was Houston. So there were inter-center relationships. We had to go to Huntsville [Alabama] frequently to train because they had the mockups and the trainers amid some of the- they had the big water tank at that time. It wasn't as big as the one we have now but it was big, and the only one big enough that you could put on a suit and go train to work outside Skylab. We had our own center heirarchy here. Pete reported to Al Shepherd who was chief of the Astronaut Office who reported to Deke Slayton who was Chief of Flight Crew Operations which included the Astronaut Office plus the airplanes and pilots at Ellington [Air Force Base], the T-38's and stuff that we would fly around the country. Plus, the flight crew training division which was very important, a separate group of engineers and trainers who were responsible for all the trainers and simulators and scheduling. So we had a very busy organization. The communications were quite fluid and open. But, we knew for major decisions Pete was the boss. Now, how did that work? It worked great. We were all three Navy. I think Pete was probably responsible for at least approving the selection of the other two crew members that he had. Pete, of course, by the time he was assigned to Skylab, had already flown in the Gemini Program on a long duration flight, for that time. He had already flown in Apollo and had landed on the moon. He was the commander of Apollo 12, so he was an experienced, highly-regarded, famous astronaut, if you will. He came to Skylab having asked for the assignment. Neither Pete nor Deke Slayton ever told us exactly what their routine was for selecting crews, but we think the way it was, was that Deke and Al got their heads together and sort of laid out a tentative schedule a few flights ahead as many as necessary, and then went to the commander that they had designated and showed him the crew selections and the commander would probably say, "Yeah that's fine," or make a suggestion.

I do know that when – this was probably a day in 1969 or maybe very early 1970, we would have a – every Monday morning at 8 o'clock we would have an astronaut pilot's meeting and this particular morning Deke came in and he had a piece of paper in his hand. He didn't usually come to our meetings, they were Al Shepherd's meetings. Deke said, "The following guys are going to work on the Skylab program," and he read off a list of 15 names. Pete's was the first name and he said, "Pete will be in charge." The rest of us after the meeting were comparing notes, wondering which 3 people were going to be on which crew, because we already knew that there were 3 flights. Because Deke didn't say that, he just read these 15 names off, put the paper back in his pocket and left. [Laughs.] He was a man of few words. There were all kinds of theories. It wasn't until about a year later that the actual names of the prime crew and the backup crews were named, and they were exactly in the order that they had been read off on Deke's list. [Laughs.] It was too simple for us to understand. It was – Conrad, Kerwin, Weitz, Rusty Schweickert, Cunningham and so on right down the line. Prime – backup – prime – backup – prime. Very simple and easy to understand.

You always knew where you stood with Deke. And you always knew where you stood with Pete, too. Pete was relaxed and confident enough to give his crew, who he had a voice in selecting, a lot of slack. We had a meeting and we organized what our different areas of responsbility would be, what we would cover each other for, and he said, "Go do your thing. We'll meet. We'll train together a lot. Come to me with problems or decisions you want made, but have fun." He gave us, in other words, a fair amount of responsibility. Pete was a very good skipper in that he didn't back away from responsibility at all, but he was cool enough to delegate responsibilities to his people.

The other thing Pete did was good, was he was an excellent team player. The team we had to particularly play with were the Mission Operations folks. The flight crew, Ops team, the Flight Director and all those folks in Building 30. We were always very dependent on them during a mission. They know the vehicle much better then you do because there's 3-400 of them to your 3. [Laughs.] They study the systems and they do the system drawings and diagrams and they do some of your training, and they build procedures, the step-by-step procedures for how to do – how to fire the service propulsion system engine in order to do a mid-course correction during a rendezvous. They do that with full knowledge of all the systems and know what all the readings are going to be on the computer and on all the gauges, what the failures could be and what to do in case of failure. It's interactive, because they build the procedure then we go try it and then we say "that stinks. Why don't you do this or that" and we compromise. You are so dependent on those guys that you can neither ignore them nor try to run rough-shod over them, it just wouldn't work.

Pete was great. He was very open. He would say at the beginning and the end of every sim, "OK guys, at the end of this I'm going to tell you how you screwed up, and I want you guys to tell us how we screwed up, then we'll both mend our ways." And he would do that.

We would part some with the Mission Ops folks. We had a baseball game down at the Cape [Canaveral]. Us against the Flight Controllers. Dick Gordon was a pretty good pitcher. [Laughs.] Dick Gordon wasn't on Skylab, but he was in the Astronaut Office so Pete recruited him to pitch. That kind of thing, Pete always kept his lines of communication open with us, with the Flight Controllers, and with his chain of command, right up to Chris Kraft, who was the center director at that time. So we always knew where we stood and the rest of the system always knew where we stood.

We fought back when we thought something was wrong. I'll give you an example. Skylab was the first mission to have significant in-flight medical experiments. We drew blood on each other. Well, I drew blood on everybody else, they didn't draw blood on me. We had a lower-body negative pressure device and a rotating chain and all kinds of good stuff up there. We had to weigh ourselves every day and eat all our food, and all that stuff. And there were efficiency considerations and some safety considerations and when we objected to something, we would squawk loud and clear. Sometimes the system would support us and sometimes it wouldn't. The example was the rotating chair experiment. It was designed to test what happens with you're susceptibililty to motion-sickness after being in weightlessness. The deal was we strapped into this chair and spun up to 10 rpm, it varied with the crew member. Then you started doing head movements like this while the chair was rotating. This is very disorienting. Your vestibular system dislikes this a lot. Somewhere aruond 50-75 head movements tyou would get motion-sick and throw up. Well, the object was to get you to this stage where you weren't quite ready to throw-up but almost. We negotiated that with the investigators. The signs were pallor and drowsiness and perspiration and nausea and mulaise. You were supposed to titrate yourself and the observer was looking at you and he would stop the test at the right point, but you felt terrible afterward for awhile. We negotiated with the system that Pete would be left off of that experiment. The other 2 of us would do it, but Pete wouldn't have to because we always wanted someone to be ready to fly us home in case of an emergency and not staggering around and feeling terrible and wishing he was in bed. They agreed to that.

Pete was a good skipper. Since we were all Navy, since we had a very well defined common goal in the mission set of requirements, we were all very interested in succeeding. Since we trained together, on and off, from 1967, which was – Pete didn't show up then, some of the rest of us were already doing development assingments on Skylab as early as 1967 – for nearly 6 years and together as a crew for nearly 3 years. We just knew each other so well that we didn't have any particular troubles. Sometimes Pete and I would get in an argument on orbit and Weitz was the stable, matter-of-fact, no bull-shit third crew member who would say, "come on guys, stop. Let's not fuss about it. Let's get on with it." So we never had a serious fight or disagreement or difference of opinion or direction during the mission. We were – I was going to say we are still good friends. Pete was killed in a car accident about 3 years ago. We always remained good friends afterward as well. That was a very long answer to a question, I'm not sure if I covered the ground.

Johnson: No, that was great. Would you say that your training had – your training together - had a great deal to do with your relationship – it really helped your relationship, your bonding?

Kerwin: Absolutely. We spent hours and we spent hours not only training, but like I said, we did a lot of training down in Huntsville, and just traveling to and from the training – flying together in the T-38s taking turns being lead or flying the flight plan would all cement that relationship. We got to where we could rely on each other.

Johnson: Did your relationship change over time, or were you always close?

Kerwin: Well, you get closer as you train and particularly close as you execute a mission like this. Interestingly enough, Pete was from an earlier astronaut class. He was from the second group of astronauts and he was in the finals for the first group. He was one of the test pilots, one of the Navy test pilots who was selected and went to the final physical exam along with Al Shepherd, Deke Slayton and Wally Schirra. The Original Seven. So Pete was up here and he was one of the stars, and so Paul Weitz and I never socialized much – I was going to say at all but every now and then there was an office party and we'd socialize there, but we didn't pal around with Pete. But when Pete stepped into the crew, he was so easy-going and open that there was no-felt barrier between us because of his status. So we worked together, we socialized some, not a great deal, even during training because we had our own circles and life-styles.

We were very close during the mission, we were close for quite - a period of a couple years after the mission because there were post-flight debriefs and P.R. trips and we went to the White House together and met the President and all that stuff. But then after that we took our own courses, particularly Pete. Pete has his own stuff that he liked to do. Pete liked to race cars. [Weitz] and I didn't race cars. I've got a feeling I'm drifting a little bit now. After the flight and in the years after we didn't stay close in the sense that we were in each others' kitchens on Friday afternoon drinking beers all the time, we were not. But we were always friends.

Johnson: What got you, particularly, interested in the space program?

Kerwin: When I was a kid I was a science-fiction buff. I loved reading science fiction and imagining about going to the moon. My big brothers used to kid me about it. I was the little knot-shouldered kid who read all the time. I would read Robert Heinlein, and C. S. Lewis and all those old guys, H. G. Wells. So in my imagination I thought astronomy and exploration were just terrific things. I never thought I could be part of it.

Growing up I went to medical school. Getting out of medical school there was a federal plan for deferring doctors while they were in training and then subjecting them to the draft to fill the military requirements and I was one of the names drawn in the doctors draft. So when I got out of med. School, I got this letter saying, "Hi there, this is the United States Navy, you've been assigned to us. Please show up at such-and-such a place in Washington, D.C. for your physical and to discuss your assignment."

So I went over there, took my physical, and sat down with the detailer as they called him with a list of potential assignments for the period beginning when my internship ended. He said, "Well, we've got a destroyer squadron. You'd go to sea on a destroyer and be the doctor for them." And I said, "What else you got?" [Laughs.]

He said, "We have a reserve base – a reserve Navy base in New England that has an out-patient clinic for the wives and kids and the retirees." And man that sounded boring. And I said, "Well, sir, you got anything else?"

And he said, "Well, we've got one seat left in the flight surgeon training class in Pensacola. But you'd have to sign up for another 6 months, this is an intensive 6 month training course. It involves some flying instruction. You won't get your wings, but you get about 25 hours of flight time under instruction because we want you to learn all about it. You sign for an extra 6 months." And I said "Sold!"

My little brother, Paul, the black-sheep of the family, was down in Pensacola when I was having this conversation starting his own flight training as a Marine Corps officer and I thought it would be really neat down there with Paul for awhile.

Being a flight surgeon and maybe going to sea on an aircraft carrier sounded like a good way of spending my 2 years – 2 and a half years now – in the Navy. So I got started at that. I met pilots. I love the environment, like the people, like the work, got so excited about it I found out there was a program for training Navy flight surgeons to be Naval aviators, put them through the full flight training. The Navy had discovered during World War II that they got some pretty good flight surgeons that way. They understood the flying environment extra well because they had trained and had actually flown with their squadrons. So I applied for that and I was accepted and went to flight training and came out the other end and went back to a flight surgeon's assignment, but this time I got to see patients in the morning and go fly in the afternoon or vice versa.

I got to know a couple of astronauts, a couple of future astronauts, pilots in one or another of my squadrons who applied to the astronaut program. Jim Lovell came to me and said, "help me fill this out, Doc. I'm going to apply to be an astronaut." And I helped him fill the medical out and he was accepted. Then Alan Bean did the same thing in the next group and he was accepted. So I had friends in Houston in the program combined with my childhood enthusiasm for space exploration – everybody at that point was – this was the early 1960's, like 1962-'63, and everybody was really excited about space flight. So when NASA announced that the next group of astronauts was going to be scientist astronauts, people within advanced degrees in medicine or astronomy or physics, I'm sitting there on the couch listening to this on the television and my wife says, "you probably want to do that, don't you?" and I said, "nah, not me, I'm not a scientist for crying out loud." But I thought about it and I applied and since I was the only – one of only two people who applied who had a medical degree, 2,000 hours of high-performance jet aircraft time and could pass the physical, they accepted the flight surgeon training as a substitute for genuine research because I had never and have never done peer-reviewed research – that's a specialty that us clinical docs don't do. They accepted that and got me in the program. So it was the tremendous stimulus in the imagination thinking that I can fly in space. Something I only read about as a kid. That's what got me in.

Johnson: You touched on before the Flight Operations, the controllers. You seemed like you had a pretty good relationship with them. Did it at any time seem like an "us versus them," or was it-?

Kerwin: Let me talk about that a little bit. First of all, I'll tell a good story about the relationship not only with the Flight Controllers, but with the development engineering community. Skylab, when it was launched, was damaged during launch, rather seriously damaged. We lost a large heat-shield that was wrapped around the workshop and it took one of the solar panels off with it and it strapped the other one down and when it arrived in orbit, it got to the right orbit but it was overheating and it didn't have enough power because of the loss of the one panel and the strapping down of the other and it was an emergency situation. The mission could not be adequately carried out with Skylab as it was then. So there began this incredible 10-day period where the engineers were trying to figure out what could be done to save Skylab. 2 things: 1, we gotta get some kind of substitute umbrella or parasol or covering over the sunny side of Skylab to cool it down and the other was we've got to try to free up that remaining solar panel or we won't have enough power to do the mission. The working of that team with the engineers in charge but the crew very much involved because whatever fancy scheme they thought up we were going to have to go try it was 10 days of very fruitful relationship between us and the engineers and the flight controllers. We were in quarentine and at that time because we were a very important medical experiment. We were isolated from everybody who hadn't had a flight-contact physical. Everybody work masks around us to make sure we didn't catch a cold and screw up the medical experiment by not being able to eat all our food. But we broke that for a couple of days to go down to Huntsville again in the water tank to try out some of these crazy methods of spreading nylon out on the sunny-side of the workshop. Those were good days because everybody was serious and working really hard, long hours but there was a lot of commorodarie expressed as well so actually we launched.

Now I'll tell a story that illustrates even in a good system you can get hung-up on communications. We got the workshop ready to go and one of the first and very important daily activities that we had to do was our daily exercise. We didn't know how important exercise was to stay fit in space. We know a lot more about that as a result of Skylab, but we felt it was important and we had a bicycle odometer, it looked like a regular bike except you could set the friction, just like you do on [one] at the gym and it was our daily exercise device. It was the only exercise device we had. It was very important that we use it every day and every 4th day we would get on the bike and pre-set force levels for each crew member and they measure our intake of oxygen and out take of carbon dioxide and heart rate and metabolic rate and everything they could think of. It was an experiment. We found it was very difficult to ride the bike in weightlessness. We had a complicated harness that fit tightly around the waist and shoulders and was strapped to the floor to hold us down because we realized that in weightlessness as soon as you push down the first pedal your body would float away from the bike. Some way you had to weigh yourself down. So we had a conventional seat and we were strapped down to the seat and you start to pedal and find that the straps cut the circulation off of your legs and the leg muscles would begin to hurt after a few minutes and you just couldn't reach the exercise levels and the high heart rates that you needed to. It was a real problem. We shared it with the ground and ran a couple of the experiment runs before we had figured out the answer. They were seeing high heart rates and relatively low metabolic rates and Pete was throwing in an occasional premature contraction which before the space program was thought to be more serious then after because it turns out normal people do it. That combination of things and the fact that the doctors on the ground were worried about long-duration space flight because a monkey had died 9 days into a 30-day mission and a Russian crew of 3 who had gone on a 21-day flight had all been found dead after re-entry. It didn't have anything to do with the flight in that case but it just made them nervous. So we were up there scratching our heads trying to figure out how to alter this harness to make life easier on ourselves and they were down there worrying about the medical – that someone was going to have a heart attack from trying too hard up there. It was about day 9 or 10 when 2 things happened simultaneously. The doctors made a decision that they could no longer allow us to carry out daily exercise except on state-side passes when the spacecraft was going over the United States. We could only communicate with the ground when we were over ground stations. We didn't have satellite and fully instrumented. They wanted us with all the electro-cardiogram stuff on so that they could watch every heart beat. I didn't see how that would help us if we blew an artery anyhow. [Laughs.] But that was their decision and the same day we made the break through of figuring out how to ride the bike without the harness. So we got this call from our flight surgeon on the private con and he told us – he obviously didn't agree with what he was reading – but he read us this letter from Dr. Berrison, laying out the new experiment ground rules. Conrad listened carefully to that and said, "I want to talk to Kraft." [Laughs.] So here Chris came over and Pete and Dr. Kraft had a conversation and Pete explained that we had solved the problem of the harness by throwing it away and here's how we're going to do it and we needed to continue exercising and Craft said, "Ok. You guys are up there you know the situation. We'll rescind the doctors instructions." And that was a show stopper narrowly averted because Pete grabbed it by the horns and communicated right to the top and said we've got to exercise, we've fixed the problem, let's skip the Mickey Mouse. So we smoothed it and didn't have any problems for the rest of the mission. The second crew went up and in the first couple days of the mission 2 of the 3 got pretty seriously motion sick and they threw up. They felt terrible and they fell behind the timeline and weren't accomplishing their daily activities until about a week into the mission at which point Alan Bean, who was commander of that mission, said to his 2 crew members, "Ok, we're all feeling better now. We're behind in our repetitions and experiments, let's really work hard – this is a 56-day mission – let's get back on the timeline. Show me you can do it." They started working 12 hour days. Owen Garriott was the scientist-pilot on that crew. He was my counterpart. He wouldn't even take his weekly shower because he didn't want to waste time in the shower when he could be doing experiments. Over the period of the 2 months they were up there, they learned to be very efficient. They learned how to do thing in weightlessness quickly and efficiently and they ended up outperforming their goals by 20 percent probably, they came back with a lot of data.

The flight controllers figured out at the end of Skylab III, which was the second manned crew, that they had learned how to do science on orbit. They said, "Look, we've become efficient. This is great." And they laid that work load on the last crew at the beginning of the mission. They forgot how long it took for the second crew to get up to speed and how seriously they had fallen behind up front. They gave them a flight plan that was too loaded up front. They set them up for failure. Then the third crew launched and the third crew didn't have any experienced astronauts on it. All three of them were rookies. They were all good. Gerry Carr was a Marine pilot. But they didn't have the experience and confidence to talk back to management quite as openly and promptly as Pete did.

Another thing was going on. The space shuttle was being designed and sold in Congress, and some people in Congress had expressed reservations about pilots' ability to manually fly and land this winged space craft that we were crazily talking about building. After long periods of time in space could we really do that? We were saying – well we're experimenting on Skylab. We're bringing people back in good shape and that all is well. But they were afraid of the space motion-sicknesses issue. Guys go up there and they're barfing their guts out for 2 or 3 or 4 days and if there's an emergency can they bring the Shuttle back and land it. So they shared this concern with the Skylab IV crew and the Skylab IV crew launched and one of them got quite sick and threw up and the crew discussed this matter. This was done day 1 of the mission while they were in rendezvous and decided not to bother Houston with it. We'll just sort of forgot this happened. What they'd forgotten was that they were communicating – they still had their helmets and gloves on – they were communicating over the intercom and the intercom was being recorded on a tape recorder which was periodically dumped to the ground. [Laughs.] So the ground got this stuff and that resulted in getting Deke Slayton calling up and telling the crew never to hide stuff like that again. Sort of a public dressing-down. Well, between that and the workload, the Skylab IV crew really got off on the wrong foot with Mission Control and they were not quite as good communicators at that point. They became hyper-critical of the schedule. The flight controllers were becoming critical of their performance and they were stabbing at each other. That went on for a couple of weeks until finally cooler heads prevailed and they took a day off and they had a conference to sort of iron things out. The ground backed off on the scheduling and the crew and the ground got to understand each other and pretty soon they took off and that crew was up there for 84 days and at the end they did just as well, maybe even a little better, then the Skylab III crew. But they did have this whipperwill at the front end of the mission that wasn't interpersonal, sort of a problem just based on basically communications. A guy wrote a book about it. His name, the author's name is Henry Cooper and he wrote a book called *A House in Space* and he focused on that. A lot of things he said in there in detail were, I thought, wrong. But it is interesting background if you get a chance to pick it up. [Pants.] Ok. End of personal data dump.

Johnson: What kind of a general feeling would you say you had about living in Skyalb?

Kerwin: A very good feeling overall. We thought that the Skylab design was excellent. We thought that the mission was well run. We felt safe at all times, and we felt that we were accomplishing something useful, which makes for a really good day. At the same time, weightlessness is a weird environment and you could just feel it do weird things to your body. We were anxious to get back home. None of us had a deep desire to live out our lives in weightlessness. We missed climbing stairs and walking up and down hills and doing the other things you can only do on the ground. I remember that after we did the spacewalk and successfully freed up the solar panel in the last 2 weeks of the mission and going strong, Houston called up. It was about day 22, I would imagine, of our 28-day mission, and they said, "We're considering flying you guys an extra week because we're still not sure whether the third crew is going to make it up. You willing to go an extra week?" Of course we'd been counting on coming back on day 28, but what are you going to say? Pete said, "Absolutely, Houston, we'd be happy to stay up here an extra week!"

A day or a day and a half later they called up again and said, "We've decided to bring up back home on time because the consumables look good, blah, blah, blah." So we said, "Oh, ok." We were very glad to come home. Does that answer your question adequately?

Johnson: Did you ever have any time for fun or leisure when you were up there?

Kerwin: We had a couple of half-day-offs during the 28 days. We also had some evening time. You know, if you've carried out your experiments and weighed yourself and cleaned up after dinner and stuff, there was some time for leisure. How did we use it? Somebody had thought of this before the flight and had packed us little personal kits or a little entertainment kit. We had about a half dozen tape cassettes each – standard little tape cassettes – and we had little personal tape recorders. We could play music. We could velcro them to the wall wherever we happened to be and play our favorite music. That was cool. That was used a lot. We had a dartboard with darts that didn't have pointy ends, they had velcro on them. That was a loser. The spacecraft was a third of an atmosphere pressure, there wasn't enough air to keep the things streamlined and they would just go end-over-end when you threw them, so we took that out, played with it once for 10 minutes, said, "Boring!" and put it back. We had a deck of cards with little velcro – not the hook but the pile – on the corner of each card, and a sort of a cloth with hook on it, so you could put the cards down. But we didn't feel like playing cards, so we put that away too. We had a couple of rubber balls. We'd spent a little time throwing rubber balls around just for fun and see how far you could throw it all the way up from the bottom of the workshop all the way into the command module without hitting the walls. But mostly the most pleasant recreational thing – oh, and we had some books, too. We were each allowed to bring three books of our own choice that we could read and that was good. But the big thing was looking out the window. The big thing was looking down at the Earth getting your geography lesson in your great trip of trips. Grabbing the map and the clock so you could figure out where you were and just assembling – there was this one big one meter diameter window in the wardroom that pointed at the Earth during the day and frequently there would be three heads in that window with bodies going out in three different directions as we looked at how pretty the Pacific Ocean was and passed over Hawaii and an active volcano in Japan, or in Russia looked for the secret Russian launch site as you went over, looked for our home towns. Took photographs – we took hundreds of photographs of everything from clouds to Chicago and wished we knew geography better because it's hard to recognize when you're flying over so fast. You can only look for about 30 seconds and it's gone. That was the recreational story pretty much.

Johnson: How did you feel about the food?

Kerwin: It was our job to be as critical as possible of the food. Which was true of all the living arrangements. But we found the food to be by and large better than expected. There were some losers. The vegetables tended to be losers. Freeze dried-add water beans were not very good. The pees were terrible and the bread wasn't good because they vacuum packed it and you'd take out a vacuum pack and it was that thick so it was not very good. But the spaghetti and meat sauce was great and the coffee was ok. The Tang was ok, nothing wrong with a little Tang. And we had a freezer so we had a few frozen food items and they were wonderful. The steak, which you just reheated in a friction heater, was delicious. Every now and then we had ice cream. Technically, if you looked at the reports, you'd find that some of us complained or reported that we thought the food tasted blander in space than it had on the ground. I don't know whether that was really true or not, but the food was ok.

Johnson: What kind of support did you receive from your family?

Kerwin: Well, lots, but not much visible during the flight. And that revolved around the issue of whether or not private communications with the family was to be allowed. We were for it; the press was against it. "It's an important national mission!" these reporters would say, "and they might say something to their spouse and loved ones that reflected on a condition that they would withhold, would lie about to Mission Control. You can't allow that!" We looked at this with amazement and said, "they used to trust officers in the Navy, but because they don't anymore, and so we – our crew chose not to have conversations with our family if they couldn't be private. So we said goodbye to them at some point before launch and saw them again after we got back to Houston. Whether based on that experience or just the fact that Skylab turned out ok, the rules were relaxed for the second and third crew, and they were allowed to have private communications with the stipulation that one trusted NASA person would listen in on their communication and would report to the Flight Director, in his own words, anything that had bearing on the mission. That didn't satisfy the reporters, but it got them off our backs, and I don't think they ever had anything to report. So the second and third crew did have periodic communication, and of course now you look and those on the International Space Station, they pick up their cell phones and call home. They're more relaxed about it now.

Johnson: Do you feel any significant change in your life from this experience?

Kerwin: Well, I had a wonderful time. There was a certain amount of adulation after for a period of time, like the quarterback who was on the winning

Super Bowl team. You know, you do interviews and stuff like that. You know this is not going to last very long, so you don't let it go to your head and you're right, it doesn't last very long. So it was a nice success. Something good to think about when maybe life isn't going so well. No major thing. People used to ask me occassionally did it change my view of religion or God? I would say, "no, it just strenghtened it." I knew it was a beautiful universe, and sure enough it is.

Johnson: What would you say is the most positive personal aspect of the mission?

Kerwin: Well, obviously it was going up there into a situation of trouble and succeeding in fixing the trouble. What astronauts worry about most, and I've read this in a book that Alan Bean wrote the other day and I thought, "Yeah, you're right, Al," wasn't death. It was failure. It was public failure, because everything you do is public. And having – if we had gone up there and been unable to pull that solar panel out, unable to put the parasol over the sunny side, an had to come back early with a failure of the program – a derelict spacecraft – that would have been awful. But since that didn't happen, that's what made us feel the best.

Johnson: Was there any negative from the mission?

Kerwin: No. I can't think of a downside.

Johnson: As a final thing, just for my research, do you know of any kind of information that you might be able to help me with?

Kerwin: Well, I recommended the book. Since you're not going to concentrate on the details of the science and engineering, then there isn't a lot of any other material out there – material that I can refer you to. What I'll say is I'm always open to you. Give me a call – and questions will arise – you'll want to check a fact or ask a background question, please feel free to do that.

Johnson: Ok.

Kerwin: But beyond that, I can't think of anything else to tell you.

Johnson: Well, I know I could ask you questions all day long…

Kerwin: Put together what you've got and come back and talk some more.

Johnson: Well, I appreciate it very much…

[Tape ends.]

VITA

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EDUCATION

- *2001-Present* - Texas A&M University, College Station, TX

  Will graduate with Honors having a major in History and a minor in English. Current GPR is 3.702. Expected graduation in December 2004.

FELLOWSHIP

- *Fall 2003-Present* - Undergraduate Research Fellowship

  The fellowship focuses on the human elements of NASA's Skylab mission. Faculty advisor is Dr. Jonathan Coopersmith of the History Department. Researched vast amounts of information on the Skylab program. Interviewed astronaut Dr. Joseph P. Kerwin of the first manned mission to the space station.

HONORS

- *March 30, 2004* – Student Research Week presenter
- *2003-Present* - Golden Key member
- *2001-Present* - President's Achievement Award
- *2001-Present* - Alpha Psi Omega member
- *2001-Present* - Dean's List

WORK EXPERIENCE

- *Summers and Christmas 2001-2004* - Space Center Houston, Houston, TX